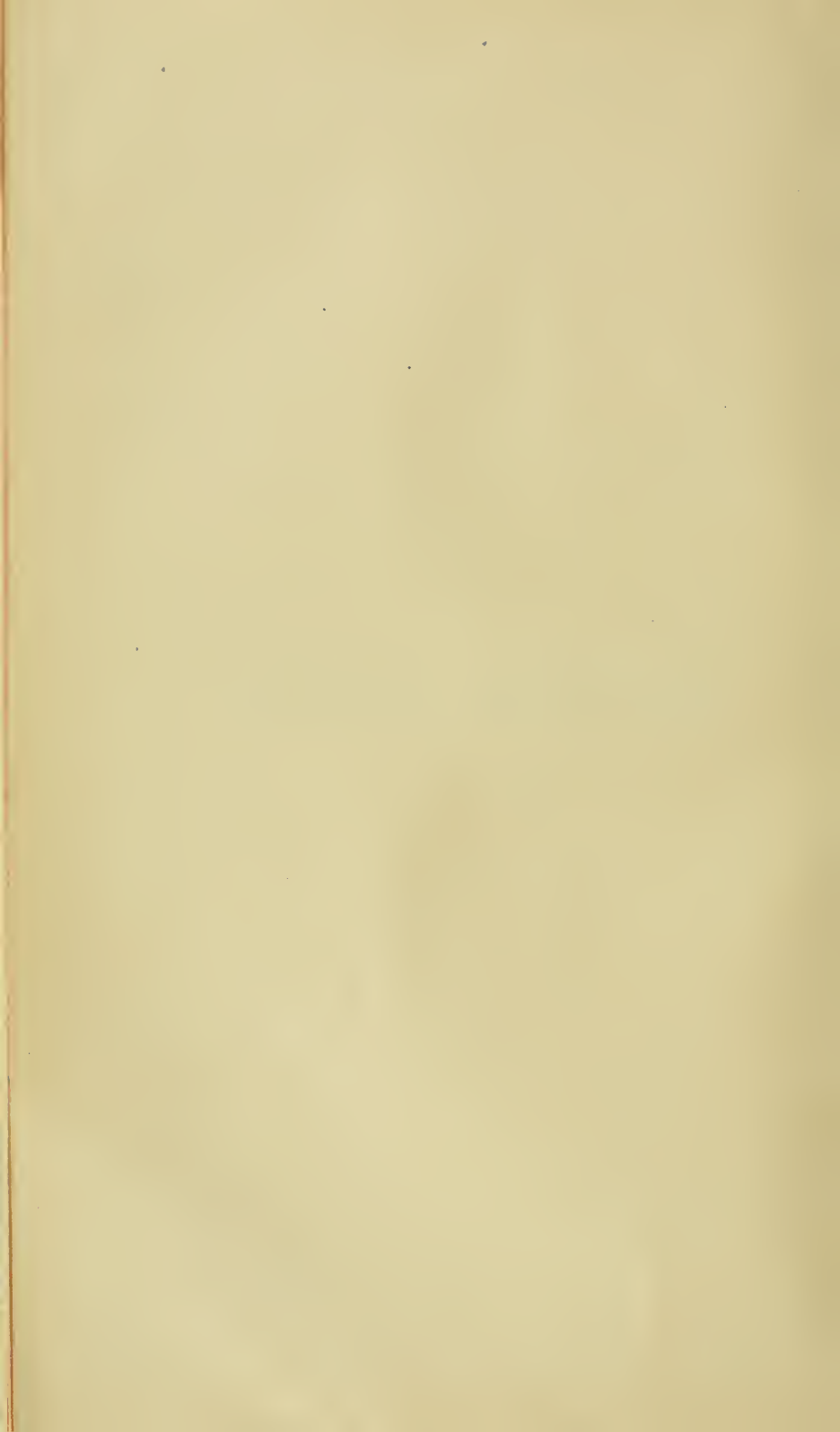


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PRACTICAL TANNING.



PRACTICAL TANNING:

A HANDBOOK

OF

MODERN PROCESSES, RECEIPTS, AND
SUGGESTIONS

FOR THE

TREATMENT OF HIDES, SKINS, AND PELTS
OF EVERY DESCRIPTION.

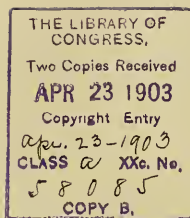
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PREFACE.

PRACTICAL TANNING, here presented for the consideration and guidance of the Leather Industrials of the United States and foreign countries is distinctively an American up-to-date treatise; no English, French or German book having been consulted in its preparation. Furthermore, in it will be found nothing whatever copied from any previously printed American book. It is what its title imports, "A Hand-Book of Modern Processes, Receipts and Suggestions for the Treatment of Hides, Skins and Pelts of Every Description." It is the result of the experience and study of the author and of those of many other practical men with whom it has been his good fortune to come into association and consultation.

One special feature of the volume to which he would call attention is that of the chapters on the Patented Processes of Tanning, Tawing, Depilating and Bating. These patents, which are given with sufficient detail to be clearly understood, serve to indicate the aims and ends of the most progressive and most intelligent investigators among tanners and chemists in the direction of placing this great industry upon a scientific basis, and what has been accomplished in that direction. The patents, the author has in most cases given with proper reserve, and without actual endorsement; but they are all suggestive, and therefore worthy of examination and investigation.

In writing this book the author has aimed to put before his readers information relating to the manufacture of many kinds of leather at once valuable and interesting. He makes no claim to infallibility nor to be above criticism. The book does not cover the entire field of leather manufacture; it does, however, contain a large amount of practical information so presented that the leather worker can readily understand it, and having made it a part of his mental capital can utilize it with benefit to himself and to the product of his skill.

Leather making as a trade cannot be wholly learned from a book; but a good book is an important aid to that end. Its value comes out only when the information in its pages is thoroughly assimilated and applied in practice. The author hopes that this one will be appreciated for its good qualities rather than be criticised for its short-comings.

In conclusion he would only add, that as is the uniform practice of the publishers, they have provided the work with a copious table of contents as well as a very full index, which will render reference to any subject in it at once prompt, easy and satisfactory.

LOUIS A. FLEMMING

Hillsdale, Michigan, April 5, 1903.

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PRACTICAL TANNING.

CHAPTER I.

SHEEPSKINS.

WOOL-PULLING—PICKLED SKINS.

THE first operation to which sheepskins are subjected by the tanner or the wool-puller is soaking. By means of this process the skins are softened, and cleaned by the salt and dirt becoming dissolved and removed from them.

The relations between the soaking process and the subsequent processes of the beamhouse or pullery, and the tannery are close; and unless the first process is properly carried out, the skins are liable to show various defects during the processes that follow. Sheep and lambskins are usually received by the tanner or the wool-puller in what is known as green-salted condition. Unless they are very heavily salted, a few hours' soaking is generally sufficient to soften them, and to dissolve the salt and remove the dirt.

In warm weather, when the water is warm, a soaking for ten hours is enough, while in cold weather the skins may be soaked without injury for from twelve to twenty-four hours, although no exact rule needs to be followed. The most essential thing to be accomplished is the removal of the salt, which when it is left in the skins causes cloudy grain, sometimes very difficult to overcome in coloring the tanned leather fancy shades.

The effects of too much soaking are loose, soft skins and a pitted or marked grain. These are not liable to occur

unless the skins or pelts are left in water for an unreasonable length of time.

The best results follow the use of clean, fresh water for the soaking. After the soaking is completed, the pelts should be removed from the water, and thrown over horses and allowed to drain for some time, or they may be passed through an extractor or wringer, by means of which the surplus water is taken from them. It is a matter of some importance that the salty and dirty water be gotten rid of before the pelts are depilated, as an imperfect grain frequently results when this is not done.

Before the process of removing the wool is begun, the pelts are often piled in heaps, and in warm weather heating sets in and the pelts are injured more or less, according to the degree of heat developed. When heating occurs, the skins rapidly decompose and the loss of the stock can be prevented only by exposure to the air at once or by immersion in cold water. The best course to be followed is for no delay to be allowed to take place, but to pass the pelts at once into the following process:

WOOL-PULLING WITH SULPHIDE OF SODIUM.

To accomplish the removal of the wool, there are several methods that may be used. The method in most common use is by the use of sulphide of sodium. This material is used in solution alone, or in conjunction with slacked lime. Patented depilatories are also in general use and produce very good results. They are used without lime, being simply reduced to a liquor and applied to the flesh sides of the pelts.

A common method of using sulphide of sodium is carried out as follows: After soaking, draining or extracting, the pelts are painted with a mixture of lime and sulphide of sodium. A solution of sulphide of sodium is also used without the lime. Very good results are obtained by combining the two articles.

The strength of the sulphide of sodium liquor should be slightly varied according to the character of the skins to be treated. For heavy bucks and merinos, the strength should be from twenty to twenty-four degrees, Baumé test; for thin, open and coarse wool skins, from fourteen to eighteen degrees. Upon young lambs the strength of the liquor should be from eighteen to twenty-four degrees.

There are no hard nor fast rules to be followed, nor is it necessary that such a rule should be observed, as the skins are not readily injured by the use of strong liquor; the material is merely wasted. In all cases the strength does not need to be greater than just sufficient to swell the skins and to start the wool.

The lime should be thoroughly slacked and reduced to milk of lime, before it is used, by the use of hot water and by being constantly stirred from the time the water is added to the lime until the latter is completely dissolved. About one-half of a barrel of lime may be used to fifty gallons of water. It is important that every particle of lime be thoroughly dissolved, since unslacked lime will injure the skins. The solution should be cool when used, and used at the consistency of thin paste. Five or six pailfuls of lime may be used in a barrel of sulphide of sodium solution. In place of the sulphide of sodium, red arsenic is sometimes used.

APPLYING THE SULPHIDE OF SODIUM AND LIME.

The pelts are spread upon a smooth surface, and the mixture of lime and sulphide of sodium applied to the flesh side. The liquor is best put on by means of vegetable-fibre brushes, and only enough liquor is put on to cover the skin without running off. While using the sulphide of sodium, the workman must wear rubber gloves to prevent his hands from becoming sore.

The pelts are next rolled or folded up with the wool upon the outside and placed in piles. If any of the sulphide

liquor comes in contact with the wool it dissolves and destroys it at once. When the weather is cold from eight to ten skins may be put in a pile together, but in warm weather not more than four or five, and if they are to lie twenty-four hours or longer they should be singled out so that one may lie over the next and so on. The painting should be done in a cool, moist room. During the summer care must be taken that the skins do not heat, and during the winter that they do not get frozen.

The wool becomes loosened in a few hours, but it is best not to remove or "pull" it until the following day, as it will then come off cleaner and easier. The length of time required, however, depends upon the strength of the depilatory solution, temperature of the room, and the season of the year. Very young lamb skins, upon which the liquor is often used full strength, should be "pulled" as soon as the wool can be removed, and then put at once into clean, cold water. It is best to "pull" the pelts double as they come from the painters, for in this way the wool only is exposed, and there is less danger of injuring it.

TREATMENT OF THE SKINS AFTER "PULLING."

After the wool has been removed from the pelts the slat should be opened flesh side out and at once put into clean, cold water to which some sulphide of sodium may be added. In this they will be safe for some time from heating or spoiling. No injury can come to skins that have been treated with sulphide of sodium so long as the grain is kept moist and not allowed to dry out and harden. For this reason the skins should not be exposed to the air any more than is absolutely necessary. The sulphide of sodium thoroughly softens the skins and removes all scruff and dirt, also the short, fine hairs. The stronger the depilatory solution is, and the longer the skins remain with the solution upon and in them, and the less the solution is washed out before liming, the weaker and less liming is required.

THE LIMING PROCESS.

While sulphide of sodium and the arsenicated depilatories are excellent agents for removing the wool, the mere removal of the wool is not all that must be accomplished before good leather can be made from the skins. The slats after being depilated, must be further swollen or plumped in order to accomplish the necessary dissolution of the animal matter in them. Lime not only does this, but it also unites with the fatty matter of the skins and saponifies it so that it can be readily removed by drenching before the skins are tanned.

Limes known as gathering limes are commonly used by many wool-pullers and tanners. It is good practice to use such limes only so long as they are kept clean and fresh. When they are used over and over, new lime is required to strengthen the old lime liquor, and unless the liquor is kept fresh and clean the leather will not look so clean and bright as is generally desired. The swelling property of a lime liquor decreases with age, while the dissolving property of an old and a fresh lime is about the same.

The first lime in which the skins are placed may be half renewed for each lot of skins by allowing one-half of the old liquor to run out and by being replaced with water. This applies to limes that have been used before, and when it is done, the second lime should be new and fresh. When it is necessary to make a new lime to start with, about two buckets of lime should be slacked in about one-third of a barrel of water. This is poured into the lime vat, and will answer for from three hundred to four hundred skins, according to their size. This first lime should be kept clean and fresh and not used too long. In summer, to get the best results, it should not be used more than for four times, or for four lots of skins, but in winter it may be used again as long. The skins should be left in this lime from one day until the next, then hauled out and more lime added, or the skins may be put into another and stronger lime.

Upon the third day the skins are again pulled out and the liquor again strengthened, and each time the skins are hauled out the lime should be thoroughly stirred up from the bottom of the vat.

From four to six days are generally required to lime sheepskins of average thickness. Very heavy skins may be limed one or two days longer. When paddle vats are used for liming, the skins are kept in constant motion, and the objects of the liming process will be accomplished in less time than when still limes are used. When the latter are used the skins should be stirred about occasionally and hauled out daily. When vat room is scarce, it is good practice to haul the skins out after they have been in the lime a few days, and to let them lie in piles for a few days. They should be protected and not allowed to dry out upon the grain.

The length of time required to thoroughly lime the skins depends upon the thickness of the skins, time of the year and temperature of the liquor. More time is required in winter than in summer.

Fresh lime should be added to the liquor and skins every day, in order to keep the former clean and sweet. When the limes are kept clean and fresh there is not the danger of injuring the skins that there is when the limes are allowed to become stale. In such limes a few days overtime will not cause any injury, but if a stronger depilant is used in connection with the lime, some care is necessary according to the quantity of such material used and the condition of the lime liquor, whether it is old or comparatively new.

While the skins are being passed through the processes preparatory to the actual process of tanning, they are in a very sensitive condition, and if they are exposed to the air for a length of time the grain is liable to show up clouds and streaks later on. When skins crack and break during the finishing processes, it is generally because the precaution to keep them moist was not heeded. Another point of

some importance is that the best results accrue when only skins of like nature and size are limed and processed together. The leather will be of much more uniform quality when this is done, than when large and heavy and small and light skins are worked through together. Some classes of skins absorb more lime in less time than others, and the lime takes effect upon such skins more readily than upon others, hence it is apparent that in a mixed lot of skins some get more lime than others and more than they need, while others do not get enough lime. This results in an uneven quality of leather. Sheepskins are sometimes burned by particles of unslacked lime and also by the use of some unreliable brand of sulphide of sodium containing iron and other impurities.

Low-liming results in close, firm leather. Over-liming in soft, spongy leather. Nothing can be done to remedy the defect caused by over-liming, while skins that are insufficiently limed are difficult to tan and do not carry oil and grease well.

Sulphide of sodium used in connection with lime renders the lime more soluble and, therefore, more easily removed by washing. When great softness and elasticity are desired in the leather, the skins require to be limed from eight to ten days and then very thoroughly drenched and washed before they are pickled or tanned. Some of the substance of the skins is dissolved and the resulting leather will be soft and stretchy. This condition is desired upon glove leather but very undesirable in shoe leather. Sheepskins are naturally soft and open and require careful treatment to get them just right. When the liming is carried too far, the fibres are weakened to such an extent as to impair the strength of the leather.

A great many of the imperfections met with in finished leather are caused by improper and careless methods of liming and drenching the skins. Some of the most serious defects are coarseness and roughness of the grain, looseness

and sponginess, or the opposite of this condition, that is, close, hard skins. If the leather, after being properly tanned, is hard and tinny, it can be usually relied upon that the skins were not limed enough, or if the grain is drawn, they were limed too much. Sometimes skins after tanning have hard black or brown spots, also spots from which the grain has been removed. These defects are generally caused by improper soaking and preparation of the skins before painting, or the skins while being treated with sulphide of sodium came in contact with rusty iron. When dissolving the sulphide of sodium, copper or composition pipe should be used. All iron should be kept away from it.

Much of the grease found in sheepskins may be gotten rid of by pressing them between hydraulic presses after liming. To prevent the slipping of skins, they should be sprinkled with sawdust. After the liming process is completed the skins are washed in clean, warm water in order to remove from them as much lime as possible, then trimmed and short-haired, and they are then ready for the drench. The ends and objects to be achieved by this process are the entire removal of all the lime and sulphide of sodium in the skins, neutralizing them and causing them to lose their firm swollen condition acquired during liming and to become clean and soft. Soft, pliable leather cannot be made until these things are accomplished. Several methods may be used to accomplish the desired objects.

THE BRAN DRENCH.

This method of drenching and preparing sheepskins is one of the two oldest methods in use. While it is not the best process that can be used, it produces very good results upon sheepskins when the work is properly done. No hard nor fixed rule can be followed in the manipulation of this drench. The operator must use judgment and this can only be acquired by experience. It goes further toward getting the right results than any fixed rule.

The bran known as "middlings" is usually considered the best to use, because it is finer and contains more flour than the coarse grades. Some wool-pullers and tanners in preparing their skins use old sour tan liquor that has been used for previous lots of skins. When such liquor is used, one pailful of bran is ample for each one hundred skins, in enough of the liquor to enable the skins to process nicely. The bran is allowed to ferment and become sour before it is used. The liquor should be always warm, at a temperature of 90 degrees, and maintained at this temperature during the operation. The skins may be left in the first drench over night, and in the morning a new drench prepared. For this warm clean water is used in place of the sour liquor, and one and one-half buckets of bran is enough for each one hundred skins. The skins may safely be left in this liquor for twelve hours in warm weather, and a few hours longer in cold weather. After the skins are taken from this drench they are worked upon the grain, washed off in warm water, and are then ready for the pickling process.

The action of the bran drench is due to the fermentation which takes place, by which acids are formed. In order to have the drench become sour as soon as it is made up and the fermentation fully developed, it is necessary to cook the bran before it is used. The tub should be about one-half full of water, then the bran put in and a pailful of old sour liquor added, and the whole thoroughly cooked by the use of steam. When no sour liquor is to be had, a cake of yeast or a gill of sulphuric acid may be used to start the bran working. One method is to use about two hundred pounds of bran for each six hundred skins of medium size. After the bran has fermented, the drenching tub should be filled with the necessary quantity of water, heated to about ninety degrees. One-half of the bran is put in, and the drench well stirred. Then one-half of the skins are placed in the liquor, which is again thoroughly stirred, then the

balance of the bran is added and the remaining skins. The skins should be put in as quickly as possible so that they will get an equal and uniform degree of heat. This is best accomplished by having the skins placed in piles along the sides of the tub and several men employed to do the work. The stirring of the drench liquor is a matter of some importance, in order that all lumps of dough may be broken up. The bran sometimes forms lumps which retain the heat, and when these open up upon coming in contact with the skins, the latter are burned and small holes and hard spots appear.

Another method of preparing and using the bran drench is as follows: For a pack of skins ranging in number from four hundred to five hundred, one-half of a barrel of bran is added to or mixed with enough water to make a mushy mass. This is allowed to stand forty-eight hours to sour, and is then emptied into the water in the drenching vat. Then are added three pints of oil of vitriol and three pecks of common salt, and the entire liquor mixed together and heated to ninety degrees. A paddling of four or five hours will generally suffice for medium-weight skins; heavy skins requiring about six hours. At the end of such lengths of time the skins will be very soft and clean, and if they are intended to be colored fancy shades may be given a slight working upon the grain. For black or dark-colored leather the drenching alone will suffice, the skins going at once into the pickle by which they are further cleaned and bleached.

The grain of the skins sometimes becomes rough and clouded in the bran drench, and the leather thus affected cannot be colored fancy shades. Frequently, too, when the fermentation of the bran is not fully developed, or the drench is used too hot, too strong or for too great a length of time, the leather cracks in the finishing. The amount of drenching required by sheepskins depends upon the amount of lime in them and the degree of development of

the drench. Less time is also required in summer than in winter. When the skins become soft and slippery and begin to settle to the bottom of the vat, they should be removed at once, given a working on the grain, washed off in warm water and are then ready for the pickling process.

A method of drenching sheepskins, that has nothing to recommend it but age and long use, is by the use of animal and bird dung. This method, at one time used almost exclusively, is being rapidly displaced by cleaner and safer and more scientific methods. The use of manure is very risky and uncertain. Constant attention must be given the stock, and even when this is done no one can tell whether a lot of skins will come out right or not, owing to the disturbing influences over which the workman has no control.

DRENCHING WITH LACTIC ACID.

Because of its simplicity, safety and cleanliness, having none of the unpleasant features of the bran drench, lactic acid is a very satisfactory article to use in deliming sheepskins. During the fermentation of the bran drench organic acids are formed, chief and most important of which is lactic acid. In fact it is this agent that neutralizes and dissolves the lime in the skins. It is not strange, therefore, that pure lactic acid should be used for the purpose of deliming skins. Its use is very simple and safe. It has no objectionable smell and more than is actually required may be used without injuring the skins. For sheepskins intended for both glove and shoe leather, it is used in the following manner: After the skins are taken from the lime they are washed in warm water, in order to remove from them as much of the lime as possible. The quantity of water necessary to drench the lot of skins is run into a vat and heated to about ninety degrees. To each one hundred gallons of water one gallon of lactic acid is added. This quantity of acid is not always required. Sometimes three quarts is a full plenty, depending upon the amount of lime in the skins. The warm

drench serves not only to dissolve the lime in a short time, but also to bring down the skins, making them soft and thin, while a cold bath neutralizes the lime and leaves the skins full and plump. The skins are placed in the prepared drench and constantly stirred about. A vat with paddles is best for this process. After being in the liquor from one to two hours the skins will be found, in the majority of instances, sufficiently drenched to be removed from the liquor. In some cases it is necessary to work the skins through the slating machine, or upon the beams. For black leather, and in most instances for colored leather and when the skins are to be sold in pickled condition, they may be drained after drenching and passed into the pickling process without further washing or working.

When the skins have been heavily limed a more thorough drenching is necessary, and the skins need to be washed before they are pickled. The drenching with lactic acid may also be done in drums. From one to two pounds of acid are used in twenty-five gallons of warm water for every hundred pounds of skins, and the stock milled in this liquor in the drum for thirty minutes. In the majority of cases no further washing is required. The next and last process to which the wool-puller treats his sheepskins is the pickling process.

THE PICKLING PROCESS.

The liquor in which the skins are pickled is composed of water, sulphuric acid and salt. It should have a sharp, sour taste, with some flavor of salt. About two quarts of acid and fifty pounds of salt for one hundred medium and large skins, makes a good liquor. Enough water should be used to cover the skins well and to enable them to be stirred about without being crowded. After the drenching process the skins should be allowed to press and drain for an hour or two, and be then placed in the pickle. They should remain in this liquor from two to four hours, and should be stirred

about. The effects of this process are to cleanse and bleach the skins and to put them into such condition that they may be kept for an indefinite length of time without spoiling. The pickling liquor may be used over and over by being strengthened up with acid and salt for each lot of skins. After one lot of skins has been pickled, about one-half of the quantities of acid and salt used in the first instance should be added to keep the liquor up to a satisfactory strength.

When used continually, about once in two months the old liquor should be run out and new prepared. After pickling the skins should be drained thoroughly or pressed, and are then ready for shipment or tanning.

The pickled skins are sorted or graded according to quality, size and substance.

WOOL-PULLING WITH NEW XXX DEPILATORY ; PATENTED.

Very good results are obtained from the use of the patented new XXX depilatory. Many wool pullers prefer this article to the regular sulphide of sodium. The methods of using this article are very similar to those that have been described for sulphide of sodium, except that the depilatory is dissolved in hot water and used alone and not in combination with lime. The sheep-pelts are soaked and run through wool-cleaning machines and extracted, or they are allowed to drain for some hours, then the solution of depilatory is applied with a vegetable-fibre brush to the flesh side of the pelts, at a strength ranging from eighteen to twenty-four degrees Baumé. The pelts are folded with the wool on the outside and left in piles until the depilatory has taken effect, then the wool is removed and the slats are limed in weak limes from one to seven days, being stirred about during this time, then worked out on the beam, drenched, washed, pickled and tanned. The lime may be dispensed with and the skins prepared for tanning in a weak solution of the depilatory or of sulphide of sodium

from four to ten degrees strength from three to six days, after which they are drenched and pickled, and good tough leather obtained.

The advantages gained by the use of this patented depilatory, or by the use of sulphide of sodium for wool pulling over the old methods in which the wool is removed by sweating it off, or by the use of lime and red arsenic, are that in the sweating process the skin must be decomposed to quite an extent before the wool can be removed, and unless very carefully watched the skins often lie too long, or the heat becomes too great, and the skins are spoiled or seriously damaged for leather purposes. When lime is used alone, and years ago it was the only depilatory in general use, the damage is mostly to the wool, by reason of its contact with the lime. When lime and red arsenic are used the wool becomes harsh to the touch, and when it is kept for a long time it becomes dry and brittle, and it also assumes a yellowish cast, and will never scour out perfectly white nor take certain aniline dyes.

The lime process and the lime and red arsenic method, depend largely upon the condition of the weather for the length of time required to start the wool. In extremely cold weather it is almost impossible to work at all, and consequently the number of skins that can be pulled is very uncertain. By the use of sulphide of sodium and new XXX depilatory these objectionable features are overcome. The results are always certain and uniform, less labor and handling are required to accomplish the work and the products of wool and skins are of a superior quality, the resulting leather also being of finer, closer grain and tougher fibre, with no loss of substance or weight. The sweating process, at one time largely used by wool pullers, has become obsolete and is never used at the present time.

CHAPTER II.

THE MANUFACTURE OF CHROME-TANNED SHEEP LEATHERS.

PREPARATION OF SHEEPSKINS FOR CHROME TANNING.

SHEEPSKINS are naturally full of grease, and before they are tanned with chrome liquors it is necessary that as much of the grease as possible be removed from them. This is accomplished by wringing them, also by the use of a hydraulic press, the latter method being generally preferred to the former, as it is more effectual. Skins that are intended for shoe leather require a very thorough pressing in order that very little grease may be left in them, as grease left in the grain prevents a clear, bright finish. Grease left in the skins is also a great barrier in the way of the dyer's getting clear and uniform shades of color.

A number of dozens of skins to the limit of the capacity of the press, are spread out smoothly between the plates of the press. To prevent slipping, the skins are sprinkled with sawdust. As much pressure as the skins can stand without injury is applied, and large quantities of grease flow from them. The pressure is so great that the skins are made to look like pieces of tin, and require a drumming in salt water to soften them. The skins are also sometimes treated with naphtha. Other methods might be used, but they not only remove the grease but take out much of the life of the skins as well.

REMOVING THE ACID FROM PICKLED SKINS.

A very satisfactory method of tanning pickled sheepskins with one bath chrome liquors, and one that is in common use, consists of the skins being first tawed with sulphate

of alumina and salt, before the chrome liquor is applied to them. In this way a leather is made that is of plump body and smooth fine grain. When this method of tanning is used, it is necessary to remove the acid from the skins before the sulphate of alumina and salt are applied. When the acid is not removed or neutralized, the leather dries out hard and tinny and lacking in strength. To accomplish the removal of the acid several methods may be used. One bath chrome liquors are not all alike and on account of their differences the methods of preparing the skins for one liquor do not always work right when other liquors are used.

A very common method of drenching pickled sheep skins consists of a solution of whiting and salt, followed by a light drenching in a bath of bran and salt. Before the skins are drenched they should be pressed and then drummed up in salt water, so as to open up and soften the fibres.

The temperature of the drench should be about ninety degrees Fah. For five dozen skins five per cent. of their weight of salt and two pounds of bolted whiting should be used in twelve gallons of water. The skins are run in the drum in the liquor for thirty minutes and are then allowed to rest in the liquor for some time. A few ounces of sal soda may be added to the liquor. After the drench of whiting and salt the skins may be thrown into a light sour bran drench for one-half hour, to, which enough salt has been added to keep the skins from smelling, after which they may be washed in warm salt water and are then ready for tanning. The skins require to be freed of all the whiting or they will be brittle after tanning. After the washing the skins should be allowed to drain for some time before they are tanned.

The whiting and salt give the skins an alkaline character which sometimes causes them to tan too rapidly upon the surface, causing the grain to become rough and coarse. The object of the second drench of bran and salt is to overcome this tendency and produce a smooth grain. A drenching

in bran and salt also answers the purpose of removing the acid without the use of the whiting. The salt is absolutely necessary in the drench to hold the skins from swelling.

A drenching in a solution of coal-tar bate and sal soda not only serves to remove the acid pickle, but to remove some of the surface grease, which is a desirable thing to be accomplished, especially if the leather is to receive a glazed finish. When the coal-tar bate is used the procedure is as follows: For five dozen medium-size skins about twenty-five gallons of water heated to ninety degrees are used. In one pail of warm water is dissolved one pound of sal soda, and in another pail two pounds of the bate are dissolved. One-half of the bate solution and all of the soda solution are added to the water. The liquor is stirred a few minutes and then the other half of the bate solution is added, and the drench is then ready for use. The skins, after being pressed and run in salt water, are placed in the prepared drench, one at a time and opened out. After being stirred about for about ten minutes it will be found that the pickle has been removed and the skins may then be taken from the drench and allowed to press and drain for some time before they are tanned.

A COMMON METHOD OF CHROME TANNING SHEEPSKINS.

Very good leather is made by applying chrome tanning liquors to a previously alum tanned skin. After the drenching and draining the skins are pickled in a solution of sulphate of alumina and salt. The usual formula is, for each one hundred pounds of skins, weighed after draining, three pounds of sulphate of alumina and six to eight pounds of salt. Glauber salt may also be used in quantity, about four pounds to each one hundred pounds of skins. These articles are dissolved in warm water before they are used, and the solution is placed in the drum along with the skins and the drum run for three-quarters of an hour, until the skins have acquired the requisite degree of softness and

smoothness of the grain. Although the sulphate of alumina is a tanning agent, it really does not act as one in this way of using it, as it is all washed out before the leather is dried out. Its principal use is to plump the skins and to prevent contraction of the fibres and drawing of the grain. When there is no hurry for the leather, the skins may be taken after the drumming in sulphate of alumina and salt, and thrown over horses and allowed to press and drain for as long a time as possible. They will improve in quality when this is done and eventually grow into much better leather. Or they may be taken, hung up and dried, and after drying be allowed to lie some time before they are chrome tanned. The longer they are left in this dry state the better will be the finished leather. When they are to be tanned they are washed back in the drum until every spot is softened, then they are given the chrome liquor.

When a continuous procedure is wanted, after the drumming in alumina and salt, and without the skins being taken from the drum, the concentrated tanning fluid is applied to the skins and the process is completed in two to three hours' time. After the skins have been drumming in the solution of sulphate of alumina and salt for three-quarters of an hour and have acquired the desired degree of softness and smoothness of grain, a solution of tanning material is prepared, consisting of, for each one hundred pounds of skin in the drum, three gallons of the concentrated tanning material mixed with three gallons of water. This solution is divided into three portions, one of which is added to the contents of the drum, skins, alumina and salt, and the drum run for thirty minutes; then a second portion is added and the stock milled for one hour; then the third portion is added and the drum run for another hour, at the end of which time the skins will be found to be tanned through. This can be ascertained by the tanner by cutting into the thickest part of the heaviest skin, and if the green liquor has penetrated every fibre, the stock is

tanned. The skins should be allowed to lie in the liquor over night, in order to give the chrome salts taken up by the skins sufficient time to act, or to take effect upon the fibres and thus to completely convert them into leather. The following morning the tanned skins are removed from the drum, and are, preferably, allowed to drain for some hours, although this is not really necessary. Before the processes of coloring and finishing the leather are begun, the skins require to be thoroughly washed in a drum or paddle vat in water, in which borax has been dissolved and added, in the proportions of one-half pound borax for each one hundred pounds of leather. In this borax water the leather requires to be washed for at least fifteen minutes, after which it is necessary to again wash it for another fifteen minutes in clean, cold water. The washing of the leather is a very important part of the process, and under no circumstances can it be slighted or dispensed with and good results obtained from the treatment.

TANNING PICKLED SKINS WITHOUT DRENCHING.

Pickled sheepskins may be also tanned without having the acid removed from them in the following manner: The pickled skins are weighed and for each one hundred pounds two solutions are prepared, one consisting of three pounds of sulphate of alumina in five gallons of water, and the other of three pounds of sal soda also in five gallons of water. Both materials are boiled with steam until dissolved. The solution of sal soda is then slowly stirred into the solution of sulphate of alumina, a small portion at a time, and short intervals allowed for the foaming to subside. The two solutions combined form a milk-white liquor. This should be allowed to become cool before it is used, or enough cold water may be added to reduce the temperature to eighty-five degrees.

The drained, pickled skins after pressing are thrown into the drum, with a solution of salt, consisting of ten pounds

of common salt in five gallons of water for each one hundred pounds of skins. The skins are drummed in this solution for ten minutes, until they are softened and opened out, then the solution of sulphate of alumina and sal soda is given to the skins. This should be given a portion at a time, and after all has been put in the skins should be drummed therein for at least thirty minutes. Then for each one hundred pounds of skins, one gallon of tanning liquor is added and the skins drummed for thirty minutes, then another gallon is added and the skins drummed for one hour, then another gallon for each one hundred pounds of skins is added and the skins allowed to drum for another hour or longer, until they are well struck through with the tanning liquor. Then for each one hundred pounds of skins in the drum, one-half pound of salts of tartar is dissolved in as little water as possible and this is added to the contents of the drum, and the drum run for one-half hour. If at the end of this length of time the liquor in the drum still shows a deep green color, another one-half pound of salts of tartar may be dissolved and given to the skins and the drum allowed to run another half hour. The tanning will at the end of this time be complete, but it is good practice to allow the skins to lie in the tanning liquor over night, and then to be removed from the drum and allowed to press and drain for some hours, the longer the better. After the draining the tanned skins require to be washed in a solution of borax, consisting of one pound of borax for each one hundred pounds of stock, and washed in this for thirty minutes and then in clean water for at least one hour, or until the stock is perfectly neutral to the taste, after which the skins are struck out or pressed, shaved, colored and dried out.

Another method of tanning pickled sheepskins,

Without removing the pickle from them, is carried out as follows: For each one hundred pounds of skins a solution

is prepared consisting of one pound of glauber salt, dissolved in eight gallons of warm water. This solution is placed in the drum along with the skins, and the drum run for ten or fifteen minutes. The skins are then thrown back upon each side of the drum on the pins of the drum, the plug pulled out and the solution of glauber salt allowed to drain off. The plug is then replaced in the drum, and for each one hundred pounds of skins ten pounds of salt and eight gallons of water are thrown into the drum and the skins milled therein for five minutes. Next is added to the contents of the drum, salt water and skins, one gallon of tanning liquor for each one hundred pounds of skins, and the drum run for one-half hour, then another gallon of tanning material is added for each one hundred pounds of skins and the stock drummed another hour, then another gallon of tanning material is poured into the drum and the skins milled for from one to two hours or until they are completely struck through, making three gallons of tanning liquor used for every one hundred pounds of leather. In as little water as possible is now dissolved one-half pound of bicarbonate of soda for each one hundred pounds of skins, and this is added to the contents of the drum and milled for one-half hour. If at the end of this time the liquor in the drum still shows a deep green color, another one-half pound of bicarbonate of soda may be dissolved and added to the contents of the drum and the skins milled for another half hour. The tanning should now be completed, but if any doubt exists in the mind of the tanner, the skins may be drummed for a longer time, or they may be allowed to rest in the liquor over night, enough water being added to the contents of the drum so that the skins are covered. When thoroughly tanned, the skins may be removed from the drum and allowed to press and drain for at least twenty-four hours. After pressing and draining the required length of time, the skins are thrown into a drum with a solution of borax or bicarbonate of soda, about two

pounds of either of these articles being used for each one hundred pounds of skins, and milled in this solution for one-half hour. On removing the skins from the borax or soda solution they are washed off for a few minutes in clean water. It is not necessary to wash them for any length of time, as is the case when sulphate of alumina has been used in tanning. The leather is then ready to be stained or colored, fat-liquored, put out on the grain and treated in the finishing operations the same as any chrome-tanned skins.

A NEW ONE-BATH PROCESS OF ACID TANNING.

A process of one-bath tanning that partakes somewhat of the nature of the two-bath process has been recently brought out, and while it is especially adapted for calf and kid leather, it also gives very good results when it is applied to sheepskins. This process is carried out as follows: For each one hundred pounds of skins ready for tanning, four pounds of bichromate of potash are dissolved. To this solution are added three pounds of muriatic acid of a strength of twenty degrees Bé. The skins are treated to this solution in a drum or a vat, preferably the latter, and should be paddled until the thickest part of the heaviest skin shows that the yellow liquor has penetrated through it. The skins should be allowed to remain in the liquor until thoroughly seasoned with the chrome liquor. Two solutions, known as S. Z. solution and S. K. solution, are used in the proportion of twenty per cent. of the former and thirty-five per cent. of the latter, are then mixed together and added to the bath of yellow chrome liquor. Then five per cent. of the weight of the skins of sulphuric acid is mixed in about thirty times its weight of water and added to the bath. To guard against the acid coming on the skins directly, it should be added to the bath through a lead-lined wooden funnel long enough to reach the bottom of the vat at one corner of the same. While these liquors are being added the skins should be

kept in constant motion. The skins are paddled for about one and one-half days and are then done. They may be left for a longer time in the liquor without injury. A peculiarity of this process is the fineness and smoothness of the grain, there being no contraction of the fibres, as often occurs with one-bath liquor.

To prepare S. Z. solution, eighty pounds of nitrite of soda are dissolved in eighty-four pounds of hot water. The S. K. solution consists of forty-eight pounds of fresh chloride of lime, forty-eight pounds of soda ash and three hundred and eighty-four pounds of hot water. The soda ash is first dissolved in the hot water and when it is all dissolved, the chloride of lime is added through a sieve, the liquor being constantly stirred. When all the lime has been stirred in, the liquor is left at rest for from one to two days until it becomes clear, then the clear liquor is used for tanning and the sediment is thrown away. Both liquors, S. Z. and S. K., may be kept in one vessel, carboy, vat or hogshead, provided the proportions are kept up, and when wanted for use, the required quantity of the liquor is taken out. A wooden tank, tub or hogshead should be used for making the solutions. This process is a patented one.

WHEN SHEEPSKINS ARE TANNED IN PADDLE-VATS.

Sheepskins are also very satisfactorily tanned with one-bath chrome liquors in paddle-vats. When the skins are tanned in this way they may be pickled in a solution of sulphate of alumina and salt before they are tanned, or they may be tanned directly after being drenched from the pickle. When the sulphate of alumina is used, it may be drummed into the skins in a pin-mill drum. To each one hundred pounds of skins three pounds of sulphate of alumina and eight pounds of salt may be used. They are dissolved in warm water, placed in the drum with the skins and the whole milled for at least one-half hour. Then the skins are taken from the drum and entered into

the tanning liquor in the vat. Or a solution of sulphate of alumina and salt may be made up in a vat and the skins left therein and occasionally stirred about for a few hours, after which they are drained and are then ready for tanning. Whether he uses sulphate of alumina and salt before the chrome liquor or not is optional with the tanner. Very good leather can be made without them.

When skins are tanned in paddle-vats the liquors are handled in much the same manner as a gambier or sumac liquor is handled. The skins are started in a weak liquor, and after they begin to tan the liquor is from time to time strengthened until it is fairly strong.

Soft water should always be used, as hard water containing lime and magnesia often causes a precipitation of the tanning material, rendering the liquor unfit for use. To every one hundred pounds of skins three gallons of tanning material may be used. One gallon is added to the water at the start, and the balance after the skins begin to tan. Or to each one hundred gallons of water two gallons of concentrated tanning material may be added, thus making a two per cent. liquor at the start. This is increased in strength by the addition of more tanning material until it becomes a four or six per cent. solution, *i. e.*, four or six gallons of tanning material in one hundred gallons of water. Some salt may also be used. It keeps the skins open and plump and receptive to the tanning material, thus hastening the process. Enough water should always be used to enable the skins to float about and turn in the liquor by the action of the paddles.

When the skins have been properly prepared for tanning they begin at once to absorb the tanning material in the liquor, and as they do this they gradually assume a green or blue color, and the tan bath, of course, slowly loses its strength and becomes lighter in color. After the skins have begun to absorb the tanning material the bath should be strengthened, in order that from the moment the tanning

commences no halt nor backward movement should be allowed to take place, but the skins tanned steadily until the process is completed. The skins gradually assume a greenish blue color, and when the color has penetrated every fibre of the thickest skin the tanning is done. This usually takes from one to two days, according to the strength of the liquor and the thickness of the skin. Enough tanning material should always be used to enable the skins to grow into plump and well-tanned leather. No harm can come to the skins by remaining in the tanning liquor longer than is necessary. It is important that every skin be thoroughly tanned before being taken from the liquor. If a thin sheet of rawhide substance is left in the center of the skins, the leather will be hard and tinny when it is dried out. Too strong solutions of the tanning material tend to weaken the leather and to make it tender. When one lot of skins has been taken from the liquor, some tanning strength still remains, and this can be utilized by another lot of skins being put into the liquor. The remaining tanning material is then readily exhausted, leaving nothing but water behind. The tanner can tell when the skins are tanned by cutting into the thickest skin, and if the skin has assumed a greenish blue color clear through, and if when scraped with a knife, a dry fibre shows the skins are tanned. After the skins are tanned they should be washed for twenty minutes in borax water and for twenty minutes in clear water.

TANNING SHEEPSKINS IN TWO-BATH PROCESSES.

When pickled sheepskins are to be tanned by any two-bath acid process, the best results will follow if the skins are drenched before they are tanned, and put into perfectly neutral condition. The removal of the acids in the skins is best accomplished by the use of whiting and salt, followed by a drench in a light sour-bran drench. The most commonly used process of two-bath tanning is carried out in

the following manner: After the pickle has been removed from the skins and they are in perfectly neutral condition, they are placed in a pin-mill drum, and for each one hundred pounds of skins a bath is prepared consisting of five pounds of bichromate of potash and two and one-half pounds of muriatic acid in sufficient water to enable the skins to work nicely. This solution, to which some salt may be added, is given gradually to the skins in the drum until all is in, and the skins are then milled until the yellow liquor has penetrated through the thickest part of the heaviest skin. This is usually accomplished in less than one hour, depending upon the thickness of the skins. When too much acid is used and the proper proportions are not kept up, the skins swell very rapidly until they look like pieces of india rubber. The salt in the liquor prevents undue swelling. The quantities of bichromate of potash and acid may be somewhat varied. Sometimes four per cent. of the former and two per cent. of the latter are sufficient.

When chromic acid is used, from four to five pounds of it are required for each one hundred pounds of skins, without any muriatic acid. The essential point in the first bath is that the skins are thoroughly penetrated with the yellow chrome liquor before they are taken from the drum. Carelessness in this respect results in poor leather. After the skins are removed from the drum they should be laid in piles or thrown over horses until the next day. They should not be exposed to the air nor allowed to dry out upon the edges. The chromic acid taken up by the skins will continue doing its work while the skins are draining, and much better leather results than when the skins are entered at once into the second bath. The surplus liquor should be removed from the skins by striking them out or by pressing them. The former method is the best to use upon sheepskins, as it serves to remove the wrinkles, which if left in the skins would become fixed in the second bath and not readily removed later.

For the second bath a paddle vat is undoubtedly the best. This bath consists of a solution of hyposulphite of soda and muriatic acid and water. Before the skins are put into this liquor they should be dipped singly into a weak solution of hyposulphite of soda and acid, as by this means a slight surface reduction is accomplished. Enough water to enable the skins to float and turn in the liquor is run into the vat, and for each one hundred pounds of skins from twelve to fifteen pounds of hyposulphite of soda are dissolved and poured into the vat. To this are added three pounds of muriatic acid. The addition of the acid causes sulphurous acid to be evolved, which is the active agent in this second bath. By means of the paddles on the vat, the liquor is stirred and the skins kept in motion. It usually requires from ten to eighteen hours to complete the process, thick skins, of course, requiring more time than thin ones. The color of the skins changes from yellow to greenish-blue. Chemically considered a reduction takes place; the chromic acid of the first bath is reduced by the sulphurous acid of the second bath to the oxide of chromium. By this method the chromic oxide becomes fixed on and in the fibres of the skins and the result is leather. The skins should be left in the second bath until the yellow liquor has entirely disappeared and the skins have assumed a uniform greenish-blue color. This change of color should be through the thickest skins before they are taken from the liquor. This completes the tanning.

A process of two-bath tanning,

The second part of which is materially different from the one just described, is carried out as follows: The first bath consists of four per cent. of the weight of the skins of bichromate of potash, that is, four pounds of the potash are used for each one hundred pounds of skins, and to this are added three pounds of muriatic acid of a strength of 20° Bé. The skins are given this liquor, diluted of course with

water, in a drum, or a paddle vat, and sufficient time given for the chrome liquor to penetrate every fibre. The second bath consists of: In one hundred gallons of water of a temperature of about ninety degrees, five pounds and five ounces of sulphuric acid are added. Into this are stirred four pounds of peroxide of sodium. This requires to be sifted in in small quantities at a time and the liquor to be constantly stirred. After the bath is ready the previously chromed skins, after draining or pressing, are placed in it and paddled until they are tanned, which can readily be ascertained by the tanner. This process gives the skins a fine, smooth grain.

FINISHING CHROME-TANNED SHEEPSKINS INTO GLOVE LEATHER.

After washing from the tanning liquors, sheepskins intended for glove purposes are struck out or pressed to remove from them the surplus water, and are then shaved, if they require it. After shaving they are colored. This is usually done in drums. Aniline dyes are very generally used. By their use a large number of shades can be produced. Very desirable effects are also produced by combining two or more dyes. In the making of colored chrome-tanned sheep glove leather, the best results are secured only when the grain of the leather is clear and free from grease and spots. Cleanliness in the processes previous to coloring is absolutely necessary. Extracts of sumac and fustic are commonly used as mordants. Sumac is generally used for light colors and fustic for dark shades. For some dark shades other materials may be used, and by the dyer taking advantage of the coloring matter in the mordant, a saving in the quantity of dyestuff used can be made. Only such a quantity of mordant should be used as will result in fixing of the dye upon the leather. When more than this is used the coloring will be imperfect.

Ox-blood is a very popular shade,

And a good color can be obtained in the following manner: For each dozen skins use about four ounces of extract of fustic. Dissolve this in sufficient water to cover the skins, at a temperature of one hundred and ten degrees, and drum the skins in the liquor for about fifteen minutes. Then add to the same bath two ounces of antimonine or of tartar emetic for each dozen skins and drum the skins for another fifteen minutes. The skins are next washed off in warm water and the color bath prepared at a temperature of one hundred and twenty degrees Fah. From two to three ounces of amaranth aniline are required for each dozen skins, according to their size. The aniline is dissolved in boiling water and the skins are drummed in the color solution for twenty minutes. Then the leather is washed off and fat-liquored. The shade can be darkened by using a color solution composed of two ounces of amaranth aniline and one ounce chocolate-brown for each dozen skins. When the tartar emetic or the antimonine is used, nothing more is needed to set the colors, but when they are not used, one ounce of bichromate of potash should be dissolved and added to the color solutions after the skins have been drumming fifteen or twenty minutes, and the drumming continued for ten minutes longer. This will fasten the dye firmly upon the leather.

A good shade of ox-blood

Can also be obtained in the following manner: As a mordant either sumac or fustic may be used, or a liquor made up of fustic and peachwood extracts. In this the skins are drummed for twenty minutes. Then dissolve the amaranth aniline, and to the solution add one-eighth of an ounce of malachite green aniline. After the skins have been drummed in the color solution for twenty minutes, dissolve and add one ounce of bichromate of potash for each dozen skins, and run the drum for a few

minutes longer. A good method of preparing the skins for the aniline dye bath is to wash them thoroughly after tanning, and then let them lie for a few hours in a warm sumac liquor. This serves to mordant the leather as well as to soften it. After the sumac bath the skins are colored.

The various shades of brown and tan

Are very popular. A chocolate brown upon chrome tanned sheepskins for glove purposes can readily be obtained by the use of chocolate brown anilines, or a combination of colors may be used as follows: Three ounces of phosphine for leather, one-fourth of an ounce of green, and one-half of an ounce of purple aniline for each dozen skins. For a more yellow shade, such as is often wanted, phosphines and orange anilines may be combined, using about one-half as much of the latter as of the former. Bismarck brown and a violet aniline produce another shade of yellow brown, as do also yellow anilines saddened with blue or purple.

Yellow glove leather

Is made by first mordanting the leather with extract of sumac or fustic and then applying a yellow aniline, which, if used alone, is too bright or fiery, may be subdued by the addition of blue or purple aniline until the right shade is obtained.

For a mahogany shade,

Use as a mordant a liquor made of either fustic or of fustic and logwood. Drum the skins in this liquor for fifteen minutes, then add the aniline solution (mahogany brown) and drum skins twenty minutes longer, after which add a solution of bichromate of potash and continue the drumming for ten minutes longer. Olive brown K is a very pretty shade. Seal browns are also in favor, also the various shades of tan, readily obtainable by the use of anilines. After the coloring process is completed the skins may be

pressed and fat-liquored by the use of one pint of egg yolk and one-half pint of olive oil for each dozen skins.

A good fat-liquor

Is also made by boiling twenty pounds of alkaline soft soap in fifteen gallons of water. To the soap solution are added forty pounds of sod oil and the two ingredients completely saponified by boiling and stirring. Enough water is then added to bring the volume up to fifty gallons. Of this fat-liquor about one pailful is used upon each dozen skins.

Another very good fat-liquor.

Is made as follows: Ten pounds of soap, four gallons of neatsfoot oil and five or six pounds of degreas saponified in fifty gallons of water. Two gallons of this fat-liquor is the quantity usually required by each dozen skins. The soap is first boiled in water until it is dissolved, then the oil is added, and finally the degreas. Then enough water is run into the tub or barrel to make fifty gallons of fat-liquor. In place of the degreas, egg yolk may be used. This is added after the solution has been cooled by the addition of cold water. The fullness of the leather may be increased by adding a solution of flour and water to the fat-liquor and drumming the skins in the mixture. The water should be struck or pressed out of the leather before it is fat-liquored. It is good practice to drum the leather in a warm drum for a few minutes so as to warm it up before the fat-liquor is added. The softness and strength of the leather are increased by applying to the grain before the skins are dried out, some neatsfoot or sod oil. This is put on after the water has been struck out, and by penetrating into the leather adds strength and softness to the fibres.

*A very practical method of preparing chrome-tanned
sheepskins with sumac,*

Previous to the application of aniline dyes, is carried

out in the following manner: For each one hundred pounds of leather, weighed after being well washed and drained, three and one-half pounds of sumac extract are scalded in a closed vessel with three gallons of hot water. Sufficient time should be allowed to get the tannin extracted from the sumac. This usually takes two hours. The prepared sumac liquor is then commingled with ten gallons of water at a temperature of one hundred degrees Fah. Instead of the extract of sumac a fresh infusion of sumac leaves may be employed; and when dark shades are to be dyed the sumac may be replaced up to one-half, by cube gambier or terra japonica. The skins are thrown into the drum with one-third of the sumac liquor, and are drummed therein for five minutes. Then another one-third is added and the leather drummed for another five minutes, and then the last portion is added to the contents of the drum and the drumming continued for fifteen or twenty minutes longer. At the end of this time the leather will have absorbed all the tannin and the spent liquor may be run off. Before doing this, however, it is well to add to the liquor and skins ten ounces of tartar emetic or the same quantity of antimonine, dissolved in two or three gallons of water, for each hundred pounds of leather, and to continue the drumming for fifteen minutes, after which the liquor may be run off and the skins dyed at once with the aniline dye, or they may be rinsed off in luke-warm water and then colored. This method of coloring carefully carried out results in full, clear, even and fast shades. The use of the tartar emetic or antimonine is not always necessary. The objects of using either of these articles are to overcome any uncombined tannin on the leather, to clear the grain and to fix or fasten the aniline dye evenly and permanently upon the leather.

Aniline dyes on this leather.

Upon leather treated in this manner the aniline dyes have a special value because of the many varied, brilliant

and beautiful shades that can be obtained with them. It is economy for the leather dyer to use only the best dyes, as good leather can be seriously reduced in value by the use of dyes of poor quality. The leather made by chrome process possesses none of the coloring properties of vegetable-tanned stock, and a great many difficulties are usually encountered by the dyer who undertakes to color chrome tanned leather without guidance or instruction. When aniline dyes are being dissolved, care should be taken to dissolve the dye thoroughly and in such manner that no sediment remains in the vessel. It is well to have the water heated to a temperature of one hundred and sixty degrees, then to add the color and allow it to go into solution, after which, unless a complete solution results, the liquor may be boiled for a few minutes. To get the best results the solution should be strained before it is used, and cleanliness observed in all the operations, both as regards the preparation of the leather and the preparing of the coloring materials. It is best to use only the dyes that are soluble in water, as they are generally more readily absorbed by the leather and produce more uniform shades than dyes that are soluble only in alcohol.

When the dyeing is done in drums, which is the preferred method, it is good practice to start with about one-third of the color solution and to add the remainder at intervals of five minutes through the hollow gudgeon of the drum. The drumming is then continued for thirty minutes, or until the bath is as far as possible exhausted. It is best to keep the temperature of the liquors above one hundred degrees Fah. After dyeing, the skins are rinsed in cold water and struck out, and dried out and finished as soon as possible so as to avoid faded spots and streaks. The skins may be stretched in frames or on boards and dried in a moderately warm room.

The aniline dyes referred to in the following instructions are the Cassella & Co. brand, made in Frankfort-on-the-

Main, Germany. The quantities of dyestuffs mentioned are for one dozen medium size skins. For small skins less dye is required and for large ones more is needed. When a large number of skins are to be colored it is a good plan for the dyer to try the proportions on two or three skins in a tub, and then to increase or diminish the quantity by the proper ratio, and to color the lot of leather in pin-mill drums.

Ox-blood shade.

To get a desirable shade of ox-blood use one ounce of Bismarck brown P. S. and three ounces of Russian red B. Carry out the operations in the manner described and a full, clean ox-blood shade will result. When either tartar emetic or antimonine is used nothing else is needed to fix the colors upon the leather.

Very desirable tan shades

May be obtained by using two and one-half ounces of phosphine 11a and one ounce of Bismarck brown in combination, also a combination of one and one-half ounces of new phosphine G and two and one-half ounces of Bismarck brown. A dark tan results from the use of three ounces of new phosphine G and one ounce leather brown A and two ounces of Bismarck brown P. S. For a very light tan use one-half ounce Bismarck brown, mixed in solution with four and one-half ounces new phosphine G, saddened or subdued with a very little neutral blue. A very pretty brown: Three-fourths of an ounce leather brown B. and three ounces of new phosphine G. In some cases the quantities of dyestuff mentioned may prove more than enough to produce the desired shade. This must be determined by an experiment on two or three skins colored in a tub. The proportions may vary slightly and still produce satisfactory colors. These dyes may also be too expensive for the average case. They are recommended, however, when extra fine leather is being made and when superior colorings are

wanted and appreciated. The cost in such instances is more than repaid by the even and rich colors that result from their use.

SULFAMINE-DYED SHEEPSKINS.

Chrome-tanned sheepskins intended for coloring with sulfamine dyes must be as free from grease as possible. The coloring is best done in drums, and the temperature of the dyeing solution should be 130 degrees Fah. In order to get thorough penetration with these dyes a small quantity of carbonate of ammonia should be added to the dye liquor, but this may afterwards be neutralized with a little acetic acid.

Yellow chrome-tanned glove leather may be produced by coloring the skins with three ounces of sulfamine yellow D, for each dozen skins, measuring from eighty to ninety feet. A light greenish-yellow is obtained by the use of three and one-half ounces sulfamine yellow A.

A rich, dark ox-blood is produced by the combination of the following dyes: one and a half ounces sulfon brown B, five ounces sulfon carmine B, one and one-half ounces haematine powder. No alkali or acid is required for this combination.

After the dyeing is completed the skins are fat-liquored for about one-half hour at a temperature of 100 degrees Fah. A good neutral fat-liquor is made of egg yolk and neatsfoot or olive oil—one pint of egg yolk and one-half pint of oil being used upon each dozen skins.

GLAZING CHROME-TANNED SHEEPSKINS—COLORED.

Fine grained sheepskins, when skillfully tanned and properly colored, may be finished in imitation of genuine kid leather. It is necessary for the finisher to get rid of as much of the grease in the grain of the leather, as possible before he can get a bright clear finish. This in many instances is exceedingly difficult to do. To assist in clearing

the grain of grease a solution of vinegar, water and bichromate of potash may be used. To one gallon of strong vinegar a few ounces of bichromate of potash dissolved in hot water are added, and the solution of vinegar and potash commingled with ten gallons of water. This solution is applied to the dried skins with a soft sponge, and must be rubbed well down into the grain. Then the leather is dried and seasoned. A clear bright finish may be obtained by the use of a liquor composed of egg albumen solution, acetic acid, bichromate of potash and water. Proportions: Four gallons of egg albumen liquor, one ounce bichromate of potash, two quarts acetic acid, and twenty gallons of water. The ingredients should be thoroughly mixed together. A light coat is applied to the leather and thoroughly rubbed in, and the leather dried in a warm room and then glazed. A second coat of the glazing liquor is usually required, and sometimes a third. The less seasoning liquor that is used to get a clear bright finish the better will be the finish, as the leather will stand handling better, and the grain will show plainly through the finish, which is usually considered desirable. There are very good seasoning or glazing liquors on the market that the leather worker can buy ready for use and thus dispense with the trouble of making his own liquors. This course is pursued by many and is to be recommended.

Sheepskins require very little, and in many instances, no fat-liquor at all to impart to them the degree of softness required in shoe leather. Neither do they need a great deal of staking and working, but on the contrary, the less they are worked and handled after drying out, the firmer will be the finished leather.

FINISHING THE SKINS INTO BLACK SHOE LEATHER.

Chrome tanned sheepskins, for black shoe leather, glazed and dull, are finished after tanning in the following manner: After the washing is finished they are struck out or

pressed and then shaved to make them of uniform thickness and the flesh smooth and clean. The solidity and firmness of the leather may be slightly increased by washing the skins from the tanning liquors in a solution of whiting and salt, using about ten pounds of salt and five pounds of whiting in fifty gallons of warm water. The skins should be drummed in this liquor for thirty minutes, then washed in water until the whiting is entirely removed, then struck out and shaved. During the shaving the leather should be kept from all stain and grease, which being acquired at this stage of the work interfere in the latter processes of finishing. If the leather is to be black the flesh is first colored blue or purple. This is accomplished by the use of logwood and sal soda or borax, or by the use of blue nigrosine. When logwood liquor is used enough sal soda or borax is added to make the color blue or purple. Some purple aniline may be used, but is not necessary. When powdered logwood dyes are used one pound of the same boiled in ten gallons of water is sufficient for one hundred pounds of leather. The skins may be drummed in this liquor for fifteen minutes, and then spread on a table and grain blacked by hand or passed through dye boxes, or the striker may be applied to the skins in the drum before they are removed from the logwood liquor. Blue nigrosine produces very satisfactory results when it is used for flesh coloring. For each dozen of medium size skins, from two to three ounces of the nigrosine are boiled until dissolved in three gallons of water. This is added to the skins in a drum at a temperature of one hundred and twenty degrees, and the skins drummed for fifteen minutes or until the color is well taken up. Unless the leather has been thoroughly washed after tanning, the blue color will not penetrate as it should.

After flesh coloring the water is drained off, and then the grain is blacked with logwood and iron liquor. A good striker to develop the color is made of five pounds of cop-

peras and one and a half pounds of blue vitriol boiled in twenty gallons of water. After the boiling, the barrel is filled to a total of fifty gallons. When coloring on a table add a small quantity of ammonia to each pailful of dye. After blacking, wash off the leather and proceed to finish it. In many instances sheepskins require no fat-liquor to make them soft. This depends upon how they were treated in the beamhouse and also upon the tannage used. Before the skins are dried out, they should be well struck out, and a coat of glycerine and water applied to the grain. This gives a smooth, soft feel to the leather and helps in the final finishing. The glycerine may be half water. It should be put on with a rag or sponge and applied evenly over the grain. After this the skins are laid out flat in a pile or placed over horses, covered up and allowed to draw for two or three hours. The skins are then again struck out, all the wrinkles removed and the grain laid down flat. A light coat of oil is then applied evenly over the grain, or no oil is used, according to the condition of the leather. The skins are then dried out, and finished up by glazing or ironing. The best finish is secured when the glazing liquor is used in dilute form and well rubbed down into the grain. The grain of the leather must be cleared of greasy matter before a good, bright finish can be obtained. For this purpose a dilute solution of lactic acid may be used, also a liquor composed of vinegar, bichromate of potash and water.

Two or three applications of the seasoning liquor are given as the skins require.

A good glazing liquor for sheepskins

May be made of the following ingredients: Five gallons of logwood are blacked with a few ounces of copperas. In place of this a solution of nigrosine may be used. Then add one and one-half pints of blood, fresh or defibrined, five ounces of glycerine and eight ounces of ammonia.

Trouble with black chrome tanned sheep, leather and prevention.

Trouble is often encountered in the finishing of chrome tanned sheepskins into black shoe leather by the color fading away during the time the leather is drying out, leaving the grain a decided blue color. Very frequently the black returns during the process of glazing and finishing, but not always; and sometimes when it does come back it is not a perfect black, but a black with a blue bottom that can be readily seen by pulling the grain of the leather apart.

This defect in the leather is sometimes caused by the leather having been insufficiently washed before it was colored; but this is not always the cause, as it occurs with the best dyers when the greatest care has been observed in washing the skins, and when the best coloring materials are used. A good method of preventing the trouble, and this is what the practical workman is interested in, is to prepare the skins for coloring by giving them a bath of sumac or palmetto extract after washing and just previous to applying the dye. For one hundred pounds of leather washed and ready for coloring, a sumac liquor may be used composed of four pounds of sumac extract and three gallons of hot water, mixed with about thirty gallons of lukewarm water. In a solution prepared in this manner the skins are drummed for thirty minutes, or until they have absorbed all of the tannin from the liquor. After this they should be lightly washed in water before being colored.

A decoction of sumac leaves may be used instead of the extract, and a combination of sumac and gambier may be employed, one-third of the former and two-thirds of the latter. Also a palmetto extract liquor made up in about the same manner as above suggested for sumac. By this treatment the skins are prepared to receive any coloring material that may be used, the same becoming firmly fixed upon the leather in such manner that it will not fade nor disappear into the leather. Upon skins treated in this

manner a very desirable blue flesh may be obtained by the use of a purple aniline, such as methyl violet, after which the grain may be blackened with a solution of logwood followed by an iron or other striker liquor, and for a final dye a fast black aniline may be used. This produces a dark blue flesh and jet black grain, but is somewhat expensive. The aniline dyes may be omitted entirely and the blue flesh and black grain obtained in the manner that has been described.

Chrome-tanned sheepskins may also be mordanted

By being dipped into a solution of permanganate of potash, described in the chapter devoted to goatskins; also by treatment with a liquor composed of bichromate of potash and salts of tartar. These methods serve as foundations for the logwood, and the coloring is made comparatively easy.

The skins may be blue-backed and grain blacked in the following manner: Mordant them with extract of sumac, then dye with violet aniline for the back; then pass the skins through logwood liquor and bluestone, and finally dye with fast aniline black upon the grain, wash off, strike out and finish.

CHAPTER III.

SHEEPSKINS.

ALUM, OIL AND NAPA PROCESSES.

PROCESSES OF ALUM TAWING.

THE animal grease should as far as possible be removed from pickled sheep and lambskins before they are alum tawed. This is accomplished by pressure, wringing or by treatment with naphtha. After the degreasing operation is completed, the skins require a drumming up in salt water in order to soften them and to open them out. Then it is necessary to remove the acid used as a pickle. This is accomplished by drenching the skins in a bath of whiting and salt or of bran and salt. When whiting and salt are used two pounds of bolted whiting and five pounds of common salt are used for every one hundred pounds of skins. The whiting and salt are dissolved in about ten gallons of warm water and placed in the drum with the skins, and the skins drummed in the liquor for twenty minutes and then allowed to lie in the liquor for thirty minutes. After this they are washed in two baths of warm salt water in order to rid them of every trace of the whiting, or the skins may be taken from the drench of whiting and salt and washed for a few minutes in a light sour bran drench, then drained and they are ready for tanning. An ordinary quality of leather is obtained by tawing the skins in a solution composed of three pounds sulphate of alumina, four pounds glauber salt, and five pounds common salt dissolved in ten gallons of water. The glauber salt may be omitted and the quantity of common salt increased to eight or ten pounds. The skins are drummed in this solution for one

hour, and should then be allowed to lie in the liquor some hours or placed in piles to press and drain for about twenty-four hours, then hung up and dried out. The skins tawed in this way require very little or no grease or oil at all, as they work out very soft and white.

An extra fine quality of alum leather.

When an extra fine quality of alum leather is wanted, possessed of good, plump body and fine, smooth grain, the skins, after drenching, may be tawed in the following manner: For each one hundred pounds of skins three pounds of sulphate of alumina and six pounds of salt are dissolved in six gallons of water. This liquid is put in the drum with the skins and the skins drummed for thirty minutes. Then a second solution is prepared, consisting of ten pounds of hyposulphite of soda dissolved in five gallons of warm water. This solution is poured into the drum and the skins milled in the combined solution of sulphate of alumina, salt and hyposulphite of soda for twenty minutes. The hypo solution fixes the tannage upon the skin fibres, making it permanent. It also thins the skins. In order to overcome the thinning of the skins, which is an objectionable feature, another solution of sulphate of alumina and salt is added. This may consist of two pounds of sulphate of alumina and three or four pounds of salt dissolved in three gallons of water and is added to the skins and the tawing materials already in the drum. The skins are drummed in the liquor for thirty or forty minutes, or until they have acquired the desired degree of plumpness. The skins are then taken from the drum and are preferably rinsed off by a single dipping of them separately in clean water, and are then horsed up for several hours to drain. Thoroughly tawed skins are produced by this method that are insoluble in cold water and even in warm water and that make merchantable leather of superior quality and fine grain. After the final bath of sulphate of alumina and salt, the skins

may be dried out and treated in the finishing operations in the same manner that chrome-tanned skins are treated. The skins may also be tawed in vats. This method is more economical than drum tawing but requires more time. The liquors can be used over and over for succeeding lots of skins. The quantities of tawing materials required at the start are the same as in drum tawing. Enough water is required to enable the skins to float and turn in the liquor, and the process can be hastened by the use of warm water, at a temperature of ninety degrees. The skins may be stirred about in the first liquor for some hours, then removed and placed in a weak solution of hyposulphite of soda, and from this solution placed in another liquor of sulphate of alumina and salt, and left therein some hours, then drained off and dried out. In this process sulphate of alumina should always be used and not alum, as alum does not produce so good results as the former article.

A process of white tawing, recently patented in Germany,
Is carried out in the following manner: After the usual processes of dehairing and drenching, the skins are placed in a bath, consisting of one part of sulphate of alumina to ten parts of water. A small quantity of muriatic acid is added to hasten the development of sulphuric acid in gas form. The liberation of sulphuric acid forms chloride of aluminum. The skins are swollen and bleached in this liquor, being left therein for forty minutes. After removal from the liquor, the skins are allowed to drain or drip and are then placed in an ammonia bath. This neutralizes the free acid, while the precipitated hydroxide of aluminum taws the skins and also forms a mordant for any color that may be applied to the leather.

Very soft and tough white leather

May be made by a modified form of calf-kid tawing applied to sheep and lambskins. For this process the skins require to be drenched in a light drench of sour bran and salt to

rid them of the acid used in pickling them. After they have drained, the skins are tawed in a tawing solution composed of five pounds of alum, eight pounds of salt, five pounds of flour, five pints egg yolk, and two and one-half pints of neatsfoot oil for each one hundred pounds of skins to be tawed. The alum and salt are dissolved and mixed, then the flour is added and then the egg yolk and oil. The skins should be warm when they are put into the drum, the tawing mixture added and the skins drummed therein for at least one hour, after which they should go into a cold alum and salt solution for several days. Taken from the liquor the skins should be dried in a warm room and left in the dry state for some time. They are then dampened and staked by hand or on a machine. For first-class skins the stock should be laid away after the first staking for several weeks, in order that they may retain all the tawing properties and make soft plump leather. After the first staking and while they are in damp condition the skins are shaved, dried, staked again, and are then finished up either in white or are colored any shade or dyed black.

Sheepskins and lambskins can be made into very soft, strong, glove leather by

The following method of tawing: For each one hundred pounds of skins ready for tanning, five pounds of alum, ten pounds of salt, twenty pounds of flour and ten pounds of egg yolk are made into a liquid paste, by mixing with ten gallons of warm water, and applied to the skins in a pin mill drum at a temperature of ninety degrees Fah. The skins are milled in the liquor-paste for forty minutes, or until they have absorbed the same. They are then dried out and stored away to become cured. The longer they are stored before they are finished the better will be the finished leather. Skins treated in this way may be finished up into a very fine glove leather. They may also

be uniformly moistened and washed with warm water, and given a retannage with one-bath chrome liquors, colored and finished up as chrome leather with very good results. No fat-liquoring after the retanning in chrome is required.

In the tanning of sheep and lambskins into glove leather,

The soluble oil known as Turkey-red oil may be used in place of egg yolk, and in the same manner ; or the skins may be treated first in a fifteen per cent. solution of the oil, dried, and the treatment with oil repeated, and the skins then tanned in the usual way. To the oil solution some carbolic acid should be added to prevent the heating of skins while they are stored to cure. Salicylic acid and tar oil may also be used in place of carbolic acid.

When pickled skins are to be tanned in the above processes, the acid should be removed by a thorough drenching in sour bran and salt, or first drenched in whiting and salt and then left for a few minutes in a light drench of sour bran and salt. Getting rid of the animal grease is also an item of much importance.

COMBINATION PROCESS OF ALUM AND CHROME.

Pickled sheep and lambskins may be worked into fine, soft leather, possessing the good qualities of both alum and chrome leather by being first tawed in a solution of sulphate of alumina and salt, composed of three pounds of the former and six pounds of the latter, in ten gallons of water for every one hundred pounds of skins. After being drummed in this solution for one hour the skins are dried out and left in the dry state for two or three weeks, the longer the better ; after which they are moistened in a drum or vat until all parts are uniformly soft and moist. Then they are tanned in one-bath chrome liquors, washed, fat-liquored with a light emulsion of oil and soap, dried out and finished in the manner usually employed upon chrome leather. When

they come from the chrome process, in order to remove the green or blue tinge, they may be washed in warm borax water for twenty minutes and then left for some hours in a hot bath of sumac. This process not only bleaches the skins, but makes them soft and elastic. After the sumac bath they may be colored any shade of color, the sumac serving as a mordant, or they may be finished up without coloring and make a very soft white leather especially adapted for any purpose where such leather is wanted.

A very good fat-liquor

For this class of stock that gives nourishment to the leather is made of ten pounds of potash soap, four gallons of neats-foot oil and ten pounds of egg yolk in forty gallons of water. The egg yolk should not be added until the soap and oil have been thoroughly emulsified and the temperature of the emulsion reduced to about seventy-five degrees Fah. Two gallons of this fat-liquor are enough for each dozen skins intended for glove leather. For shoe leather less fat-liquor is required. Before the skins are dried out they should be well struck out or pressed, and the surplus water removed from them. Then a light coat of oil may be given the grain, and if the oil is warm when it is put on it will penetrate readily into the leather and add strength to the fibres.

SHEEP AND LAMBSKINS OIL-TANNED.

Sheepskins and lambskins when tanned in oil make very soft, elastic leather, very useful in making gloves and mittens.

For this method of tanning, the skins should be very thoroughly limed, and then freed of all lime before they are tanned. A good method of washing out the lime without injury to the skins is to wash them in a warm bath of lactic acid in a drum. This may consist of one gallon of the acid mixed with one hundred gallons of water at a temper-

ature of 90 degrees F. A washing in a drum for thirty minutes serves to wash out all the lime, after which the skin may be tanned without further treatment.

When pickled skins are to be oil tanned they should be drummed up in salt water, and then drenched in a light sour-bran drench in order to get them perfectly clean and free from acid.

Before any oil is applied the skins should be allowed to drain well and then pressed and as much as possible of the surplus water removed from them. The process of oil tanning is carried out best with appliances and machinery especially designed for the purpose. Newfoundland cod oil of the best quality produces excellent results. The skins are heavily sprinkled with the oil, and then subjected to machinery, by means of which the oil is forced into the skins. The work of oiling and treating the skins is repeated two or three times, or until they have assumed a decided yellow or mustard color.

After this part of the work is completed the leather is made to undergo a process of heating, by which the oxidation of the oil begun during the previous process is completed by the fermentation that takes place in the skins. The skins are laid in a moderately warm room in heaps and allowed to heat. The heat is generated spontaneously, and the piles of skins must be closely watched and frequently turned over. The highest temperature allowable is 140° Fah.; a temperature higher than this seriously damages the skins. All organic matter in the skins is destroyed. This process of heating is a very delicate one and upon its being properly done depends the success of the leather.

Unless sufficient heat is generated the skins will rot; and when too much heat is produced they become dissolved. When the fermentation ceases and the skins are no longer capable of heating they are treated to remove surplus oil. This may be done by washing them in hot water, and then subjecting them to pressure by means of a hydraulic press.

A great deal of grease is squeezed out in this way. The finishing process consists of drying out the skins and working them soft, and removing all roughness and unevenness from the flesh. In some instances the skins are hung up in a warm closed room, instead of being placed in piles to ferment.

Very soft tough glove leather

May be made by treating sheep and lambskins with a mixture composed of four pounds of alum, six pounds of salt, twenty pounds of wheat flour, and five pints of egg yolk and two and one-half pints of olive oil. These articles are thoroughly mixed together in twelve gallons of warm water, and are used for each one hundred pounds of skins. The skins are drummed in this mixture for thirty minutes, and then hung up and dried out. They should be left in the dry state for some months to cure, and may then be worked out and finished. It may be interesting for the tanner to know that the soluble oils known as Turkey-red oils or alizarine oils may be used in place of egg yolk. They may also be used upon chrome tanned skins in place of emulsions of soap and oil.

Sheep and lambskins may be oil-tanned

By being passed through a warm twenty-five per cent. solution of the oils, or they may be treated with the same in a drum. After the treatment with oil, the skins are placed in piles and allowed to heat, by being covered up in a moderately warm room. They are then hung in the air and dried slowly, after which they are again treated with the oil, being first washed in an alkaline solution and then having oil applied in the same manner as at first. They are again allowed to heat, dried again and washed in a weak solution of borax or other alkali. The drying and treating with oil may be repeated from two to four times, after which the skins are dried and worked out soft. The results may be changed by greater or less concentration of the oil solu-

tion, by higher temperatures in drying and by being passed more often through the oil solution. As has been suggested, the skins may be tanned by a combination of the oil with the salts of alumina. One method of doing this is to steep the prepared skins in an oil solution and then dry them out. The operation may be repeated and then the skins tanned with alum and salt in the usual way. Or the soluble oil may be used in place of egg yolk in any process where such article is used, and after drying out the skins they may be finished into alum leather of a superior quality, or they may be uniformly moistened with warm borax water and tanned in a one-bath chrome process. Very desirable glove leather is made in this way.

To the oil solution some carbolic acid may be added to counteract the too strong heating of the skins while they are stored to cure. In place of carbolic acid, other suitable substances having a similar effect, such as salicylic acid and tar oil, may be used. The advantages of using Turkey-red oils in tanning are great softness and toughness and uniform diffusion of the oil throughout the leather.

THE MAKING OF NAPA LEATHER.

The cheapest tannage by which sheepskins are tanned is the Napa tannage, so called because it originated in Napa, Cal. The process is more of a curing than a tanning one, as it really only cures the skins. The process may justly be considered a soap and oil tannage. The leather it produces is possessed of considerable strength and softness, and is used for linings, bindings, gloves and suspender work. For this tannage light-weight skins are used. Three classes of leather are made, white, dull and black in dull and glazed finishes. For the white leather the poorer skins are used. As they are finished upon the flesh side, the quality of the grain is of no importance. For black, Napa skins of medium quality are used. The ones of fine grain are glazed, while the poorer quality skins go into dull finish.

The original process of making Napa leather consisted of removing the wool by sweating, and then treating the skins to the tanning process. No lime was used at any stage of the process, and the skins were thus left flat and the strength of the fibres was not weakened. As the process of preparing the raw skins has changed considerably, various modifications have crept in. At the present time the wool is removed by the use of sulphide of sodium and lime. The skins are given very little or no lime at all, but of course need to be thoroughly washed before they are tanned or pickled. Large quantities of skins are received by the tanners in pickled condition, having been pickled in sulphuric acid, salt and water. These skins are first pressed in a hydraulic press to remove the grease and are then drummed up in a solution of salt and water to get them in suitable condition to be tanned. The original Napa process consisted of the following method of tanning: For about two hundred skins, twenty pounds of salt, thirty pounds of white rock potash and three hundred gallons of water constituted the first part of the process. The skins were left in the liquor for two or three hours, then wrung out very dry and immersed in the second solution. This consisted of twelve pounds of hard soap, two gallons of neatsfoot oil and one hundred and fifty gallons of water. The skins were left in this liquor until the liquor had thoroughly penetrated them, then they were dried out and passed through the process a second and even a third time, as they seemed to require. After the last drying the skins were washed in clean water to make them clean and soft and were then colored any desired shade, or blacked or left white, as was desired by the tanner.

Pickled skins are really partly cured when received at the tannery, and in some instances it suffices to merely neutralize the acid in them. For this purpose soda and oil are sometimes used, also borax and oil. For white leather the skins receive no further treatment, but are dried in a warm room and as rapidly as possible.

Coloring black Napa.

Black Napa leather is generally colored blue on the flesh side. This may be done by the use of Direct Blue Paste, a paste specially prepared for the purpose. It produces a full, dark blue shade, and penetrates the skins from flesh to grain. This is the method of using it: For ten dozen skins direct from the press, two gallons of the blue paste are dissolved in ten gallons of water, and the skins are drummed in this liquor for three-quarters of an hour, then allowed to lie over night and are tanned the next day. A good blacking for this class of leather is made as follows: Five pounds of nitric acid, five pounds of muriatic acid and one pint of water. Enough wrought iron chips are used to kill the acid, then seven pounds of copperas are dissolved in five gallons of water and added to the above. A good "sig" is made of forty gallons of water, twelve pounds of salts of tartar, five pounds of bichromate of potash and one quart of ammonia. These formulæ are in practical use and giving good results.

The skins, after becoming dry are moistened and then dampened down for staking. This is usually accomplished by dipping the skins in water and then letting them lie in piles until they become uniformly moistened. When in just the right condition, the skins are knee-staked for the purpose of softening them and to get rid of all stretch. After this work is completed, the skins are tacked or stretched upon boards in moist condition and left until thoroughly dry. When they are dry they are buffed on emery wheels. Upon the white Napas this is a very important part of the work. The buffing is done to remove the surplus flesh and to make the skins clean and smooth upon the flesh side. The black napa leather is finished upon the grain in dull and glazed finishes. The dull finish is obtained by ironing the skins while they are slightly moist with seasoning, and for the glazed finish the skins are glazed upon machines.

The following process produces very soft, tough leather,

Especially adapted for cheap gloves, button fly linings and similar purposes. The leather is very similar to Napa leather, in fact it is a Napa process. The skins are treated in the beamhouse in the usual way. Very little or no lime at all is required, the skins being merely depilated either by the use of sulphide of sodium or by a mixture of sulphide of sodium and lime. For ten dozen sheepskins of average size, prepared for tanning, a solution is prepared composed of two pounds of caustic soda and one pound of borax in sufficient water to cover the skins. This solution and the skins are placed in the drum and milled for thirty minutes, after which the skins are removed from the liquor, hung up and dried out. They are next immersed in a liquor composed of five pounds of hard soap, one gallon of straits or neatsfoot oil, one-half pound caustic soda and seventy-five pounds of water. In this solution the skins should remain until they have become thoroughly softened, after which they are put into a drum with a part of the second composition and run for about thirty minutes, being then removed and dried as before. In many instances this process thoroughly tans the skins. When not considered quite satisfactory after drying out the second time, they may be soaked soft in the second liquor or drummed in drums and worked through the process a second time. Some skins require longer treatment than others. After they have been treated in this manner and have become leather, they are put into a very weak solution of soap, oil and caustic soda, thoroughly mixed with water, in order to soften them, and in this moist condition they may be colored any desired shade, or for white leather they are dried without further treatment and then worked soft. By this process leather is made that never cracks nor does it pull apart after being sewed.

The less lime that is used in preparing the skins the

better, and as no acids are used in the process, the fibres of the skins are left in their natural state and strength.

*Another process of preparing sheepskins for linings, bindings
and similar purposes,*

Is carried out as follows: The pelts are depilated in the usual manner and then limed for a few days in weak limes. For tanning six dozen sheepskins the following composition is used: Eighteen pounds of salt, two pounds of sulphuric acid, thirty-six pounds of sumac or quercitron bark, two ounces hydrochloric acid and one hundred gallons of water. The strength of the sumac or bark is extracted with hot water, then the salt is added, and finally the acids, and the whole mixture is thoroughly incorporated by stirring. The skins are treated to this solution in a paddle-vat, although a drum may also be used, and after tanning they are hung up and dried out, then moistened back and either blacked or colored or left white and finished by working and ironing.

*To produce quickly and cheaply a soft, tough leather from
sheepskins,*

Suitable for gloves and mittens, or any other purpose where a soft, tough leather is required, the following mixture may be used: Seven pounds of either alum or sulphate of alumina, three pounds of glauber salt, four pounds of common salt, ten gallons of soft water, five pounds of ground sumac, three pounds of oak bark, one pound of nutgalls and four ounces of sulphuric acid. In preparing the mixture, the alum, glauber salt and common salt are dissolved in the water, then the sumac, oak bark and nutgalls are added and boiled briskly for twenty minutes, then such mixture, while hot, is strained, and the four ounces of acid are added and the mixture thoroughly stirred. The liquor is preferably used warm, at blood heat, and the skins treated therein for a period of twenty-four hours, being stirred about for one hour, and then allowed to rest in the liquor for the

remainder of the time, being stirred about occasionally. The process can also be carried out in drums and the skins drummed in the liquor for one hour and then allowed to drain for a few hours.

Upon coming from the liquor the skins are given a thorough striking out upon both the flesh and the grain sides with a glass slicker. This is followed by a moderately heavy coat of lard or neatsfoot oil applied to both sides. Then the skins are hung up in a warm room and allowed to dry, thus completing the process. By the use of the mixture described, skins can be tanned very quickly and cheaply and the resulting leather can be colored any shade. The leather is, to quite a degree, impervious to moisture. Before applying the oil, which should be warm, the water should be thoroughly struck out of the skins. The leather should be worked as it dries, the working and drying continued until the skins are thoroughly dry and soft.

*The following process is especially adapted to sheepskin
fleshers,*

To be used in the manufacture of gloves, for bindings, etc. The quantities of tanning materials mentioned are sufficient for two dozen fleshers of ordinary size. The fleshers are immersed, stirred about and pounded for about thirty minutes in a fluid prepared as follows: One pound of alum is dissolved in one and one-half gallons of water which is readily done by boiling. Then in another vessel are mixed one-half pound of flour and one-half pound of oatmeal or one pound of either alone, with one gill of oil and one and one-half gallons of water, and this mixture is mixed with the alum solution. The tanning materials may be applied to the skins in a drum, and at the end of thirty minutes the skins are taken out of the drum. They are then immersed for thirty minutes, either in a vat, tub or drum, in a fluid mixture composed of one gill of ammonia, one-half of a bar of soap, one-half ounce of soda, one-half pound of salt and

about two ounces of whiting or ochre, all boiled in one and a half gallons of water. To this solution is added either one pound of flour or one pound of oatmeal mixed in one and one-half gallons of water, and the fleshers drummed in the mixture for thirty minutes, after which they are dried, worked soft and finished upon either the grain or the flesh side. The skins dressed in this manner are very soft and pliable, with much elasticity, and strength of fibre without roughness.

After the skins have been treated to the first part of the process they may be dried, staked and finished on either or both sides without being subjected to the second part of the process, and when this is done they are of very good quality and susceptible of taking a very nice finish. Yet it is preferable to use the entire process in dressing the skins, as they are thus given a superior quality and a capacity for a better finish than when only the first part is used, and when finished they bear a close resemblance to castor or mocha glove leather.

In order to get the skins soft and elastic, and at the same time tough and strong, it is necessary that they be handled in such a way in the early processes of the beamhouse as to prevent any loss of substance or strength. The use of sulphide of sodium in removing the wool shortens the time consumed in the preparation of the skins and at the same time helps to make tough and soft leather. A liming of from six to eight days is generally sufficient for heavy skins, and after the liming is completed the drenching should be carefully done. The bran drench produces a very soft skin, as does also lactic acid, the latter article being very simple and safe to use.

The drenching may be done in a drum, about three quarts of acid being used in one hundred gallons of warm water and the skins drummed or milled for not longer than thirty minutes.

Sheepskin fleshers may also be tanned by any of the chrome processes,

And after tanning should be well fat-liquored. A good practice is to add a solution of flour and water to the fat-liquor. This increases the fullness of the leather as well as its strength and softness. Very good leather can also be made from the fleshers by tanning them in a mixture of alum, salt, oil and flour, then drying them out and working them soft by staking. The softness of alum-tanned skins is produced by a mixture of egg yolk and olive oil mixed with the alum and salt or applied after tanning. The longer the tanned skins lie in dry condition before being worked out and finished, the softer and finer will be the texture of the finished stock.

When the fleshers are received by the tanner in pickled condition they require a drenching in sour bran and salt in order to remove from them the acid before they are treated with the alum and salt process.

CHAPTER IV.

WOOLSKINS.

THE TANNING OF SHEARLINGS, SHEEP PELTS FOR MITTENS, RUGS AND SIMILAR PURPOSES.

The tanning of sheepskins with the wool on, for rugs, mittens, linings and similar purposes, is not a very complicated process. Yet in order to get the best results at low cost, some attention, of course, must be given to the details of the work. All useless parts of the skins should be cut off and the skins soaked for a few hours in water and then fleshed. One good method of tanning the skins is carried out as follows: Mix to a paste with a little water, and dissolve half an ounce each of borax, saltpeter and glauber salts for each skin. Spread this with a brush over the flesh of the skins, using it more freely on the thicker portions. Double or fold the skin together with the wool on the outside, and leave it in a cool place for twenty-four hours. Wash each skin very clean and apply in the same manner a mixture of half an ounce each of borax or sal soda, two ounces of hard white soap, melted together but not allowed to boil. Fold the skin wool side out and leave it in a warm place twenty-four hours. Dissolve a quarter of a pound of alum, half a pound of salt and two ounces of soda in enough hot water to saturate each skin. When the hands can be borne in the solution, put in the skins and leave them in twenty-four hours, then wring them out and hang them up to dry. Work the skins as they dry until they become at once dry and soft. Finish up the skins upon an emery wheel and then rub them with pumice stone.

To color the skins

Stretch them tightly, skin side down, upon a smooth board, and tack firmly, then lower the board into the bath of prepared dyestuff so that the wool only is exposed to the dye. Before coloring the skins wash the wool thoroughly with soapsuds and then rinse out the suds with clear water. After coloring rinse the skins with water and dry them out. When white wool is wanted, it may be bleached with brimstone, as will be described later on.

Another process,

Somewhat different from the foregoing, but equally as good, is the following: Soak the fresh skins in soft water for twenty-four hours, then flesh thoroughly to remove grease, flesh and blood. Then work the skins in warm soapsuds and rinse in clean water until the wool is clean. Spread the skins, flesh side up, and apply to them a mixture of salt, alum, saltpetre and bran. This may consist of one pound of salt, half a pound of pulverized alum, half pound saltpetre and twice the bulk of the whole of bran. Fold the skins up tightly and let them lie in a cool place for a number of days, the longer the better, then scrape off the mixture, dry out the skins and work them soft. The skins are made very soft and white, by being tanned in a mixture of bran, salt and alum in this manner: Mix bran and soft water sufficient to cover the skins. Immerse the skins and keep them covered for twenty-four hours, then remove, wash clean and carefully remove all flesh. To one gallon of hot water add one pound of alum and one-quarter pound of salt. When dissolved and cool enough to admit entrance of the hand, immerse the skins for twenty-four hours, then dry them out. Stir the liquor again, immerse the skins and leave them for twenty-four hours, then dry them again and work them soft.

A tanning solution may also be prepared

Of ten gallons water, one-half bushel wheat bran, seven

pounds salt, four pounds alum and two pounds of sulphuric acid. Dissolve and mix these ingredients together and then place the washed skins in the liquor. Allow them to remain in the liquor from twelve to twenty-four hours; the longer they are left in, the better tanned they will be. Then let them drain well, and then dry them out and work them soft. Usually alum-tanned sheepskins dry out soft without any oil being required. The softness may be increased by applying to the flesh side a coat of oil before the skins are dried out. A paste may be made of the ingredients mentioned above and this spread evenly over the flesh side, and then the skins allowed to lie some hours, and then dried and worked soft. When a liquor is used it is necessary to wash the wool before the skins are colored and finished.

Sheep pelts with the wool on may also be tanned

In the following manner: The pelts should be thoroughly washed in warm soapsuds, and fleshed, and well rinsed in clear water before they are tanned. When the pelts are well cleaned and scoured make a brine of common salt at blood heat until no more will dissolve. Then prepare a quantity of mucilage by passing hot water through a fine sack filled with clean wheat bran. Also dissolve a small quantity of starch in warm water. Let the brine, mucilage and starch water settle until quite clear, then pour them carefully together into a wooden or earthen vessel of sufficient dimensions to give free motion to the pelts when they are stirred. When a large number of skins are being handled vats or tubs should be used. Prepare a strong alum solution, and dip the pelts in this several times or let them lie therein for two hours. The liquor should be warm. Then rinse the pelts free from the alum water and wring or press them as dry as possible. When all is ready pour into the vat the mixture of brine and mucilage, at blood heat; add a small quantity of sulphuric acid, (two pounds of acid to ten gallons of water or mixture,) and put the pelts in

quickly, stirring them as briskly as possible for a few minutes. Then take the pelts out, let them drain, and then scrape the flesh as dry as possible, and then put them back in process for one hour. Be careful to have the mixture touch every part of the skins. Hang the pelts in a dry room until they become dry enough to pull out white when they are pulled or stretched in any direction. Continue the pulling and working while the pelts are drying, as a great deal depends upon the skins being worked when they are just dry enough to pull out white when stretched, and by continuing the stretching and pulling until the skins are thoroughly dry and soft. When the pelts are dry they should be beamed with a dull knife and finished upon the flesh side by being polished with coarse sand-paper.

The following is a cheap and simple method of preparing sheep-pelts with the wool on.

Make a strong lather of soap and hot water. Let it stand until it becomes cool. If the pelts are salty, soak them before washing, for a few hours in water until the salt is dissolved. Then wash them in the soapsuds, picking from the wool all the dirt and burrs that will come off. A little paraffine, or turpentine—a teaspoonful of either—to three gallons of water will help in removing the impurities. Wash the pelts thoroughly in the soapsuds and squeeze the wool until it is quite clean. Then wash them in clean, warm water until all the soap is removed. Dissolve for each skin one pound of salt and one pound of alum in two gallons of hot water, and mix the liquor with sufficient water to cover the skins in a tub or vat. Let the skins soak in the liquor for twenty-four hours and stir them about occasionally. Then remove them from the liquor and allow them to drain thoroughly. When they are well drained they should be stretched on boards or hung up until dried out. Before they become quite dry they should

be sprinkled on the flesh side with a mixture of pulverized alum and saltpetre well rubbed into the skin. These articles may also be dissolved and applied to the skin in liquid form. Try the wool to see if it is firm upon the grain; if not, let the pelts remain a day or two longer in the alum and salt liquor and then dry them out again. Dry them in a warm room, and work and stretch them occasionally as they dry until they become thoroughly soft and dry. To remove the salt and alum from the wool, the pelt should be stretched out and the wool washed with a solution of soap and water, after which it may be bleached with sulphur. The pelts may also be tanned, after washing and rinsing, in a solution composed of glauher salt, borax and salt. Leave skins in this mixture for twenty-four hours, then dry them out as above suggested.

The salt and alum used in tanning sheep pelts have the effect upon the dirt and grease in the wool to set them and thus to make it very difficult to remove them after tanning. For this reason the pelts require to be thoroughly washed before they are tanned, and at the same time they must be watched and washed carefully so that the wool will not start or become loosened.

During a process of alum and salt tanning the pelts should be handled about in the liquid so that all spots will become uniformly tanned. When tanned they should be allowed to drain, and may then be painted upon the flesh with a paste made of flour, salt, alum and water. The ingredients should be boiled until the paste thickens, and after it becomes cool the paste is spread on, and well rubbed into the flesh. The skins are next folded up and placed in piles for a day or longer until thoroughly tanned. The entire process may be carried out without tubs or vats, the skins being painted every day for three days until they are completely tanned. The scouring of the wool after tanning should be done on a table built for the purpose. The pelts are laid on the table flesh side down and struck out smooth

with a copper slicker, to prevent the washing out of any of the tannage. For scouring the wool, suds made of water, soft soap, soda-ash and salt are used. The strength of the suds must be determined by the condition of the wool as regards grease and dirt. Too strong suds not only darken the wool but render it rough and harsh. In the washing of the pelts before tanning soft water should be used. Borax added to the water not only helps in the cleansing but gives a soft feel to the wool.

For white woolskins the alum and salt tannage is used, as this does not color the wool; but when the wool is to be colored fancy shades or black, other processes may be used. When bark is used as a tannage the wool becomes darkened, and turns into a golden brown when it is scoured.

Some sheepskins are very greasy, much more so than others, and these greasy skins sometimes take the tawing materials very slowly. A great deal of trouble is met with because of the grease in the pelts. Very often the grease comes through upon the wool after the pelts are cut up into finished articles; at other times the grease causes trouble by staining the lining and making a bad odor. The greasy skins should be very thoroughly washed and beamed before they are tanned. A weak alkali liquor helps to remove the grease. In the case of very heavy and greasy skins it is sometimes necessary to treat them with naphtha. Usually tanners have not the facilities for doing this work, and the skins are sent to men who make a business of removing grease from skins tanned with the hair or wool on.

To tan the skins in bark extract they should be soaked and washed in warm soapsuds and then rinsed in clear water in order to get them as clean as possible. The tanning liquor is made up of salt, alum and extract. Hemlock is largely used, although others give just as good results. The pelts are left in the liquor one day, then hauled out and drained, and the liquor in the vat strengthened by the addition of a few pailfuls of dissolved extract. It is good

practice, as it helps in the tanning, and to give the skins a velvety feel to add to the liquor a pailful of dissolved soft soap or potash soap. The complaint most commonly made against skins tanned in alum and salt is that they become moist and heavy on a wet day. For this reason bark tanned skins are often preferred to alum tanned as they are not readily affected by moisture.

The skins should be hauled out of the liquor every day until the liquor has struck through from flesh to grain. Thorough tanning is necessary if soft tough skins are wanted. When the tanning is completed the pelts should be well drained and then oiled. Neatsfoot oil is good, but somewhat costly for the work, and cheap mineral oil is almost as good as neatsfoot. In place of the hemlock extract any other extract may be used, also combinations of different extracts. Gambier is a good tanning material for this class of goods. The process may be used as a two-bath process, by first applying the alum and salt, and then the tan liquor. Skins tanned by any of these processes are readily colored any dark shade or black. To get the wool clean and free from grease so that it will readily take the color, requires a thorough washing and cleansing. A desirable shade of brown results when the wool is thoroughly washed and dried and finished without coloring.

The first step is to rinse the skins to get rid of particles of dirt and dust. The scouring suds may be very strong and well and evenly rubbed into the wool to get even results. The effect of this scouring is to leave the wool a dark brown color. When this is considered too dark and a light golden color is wanted, the pelts after scouring, are thoroughly washed with clean water to get rid of suds, and then treated to a sour liquor made of water and sulphuric acid. Enough acid is required to give the liquor a sharp, sour taste. This liquor is spread evenly over the skin until all parts of the wool come in contact with it, after which the wool is again rinsed off and wrung or pressed and the pelts hung up and dried again.

To bleach the wool on alum-tanned sheepskins.

For this purpose nothing is better than brimstone. The pelts to be bleached must be uniformly moist, wool and skin, and hung on sticks in a large vat or hogshead. In the bottom of the vat or hogshead, the brimstone is placed in a kettle. Live coals are required to start the burning of the brimstone. The vat or hogshead should be kept covered during the operation to keep the smoke in. If the first operation does not bleach sufficiently white, the work may be done a second time. A caution to be observed is not to allow the skins to come too close to the fire.

A very simple and effective method of removing the grease from sheep pelts

Is carried out as follows: When the pelts are taken from the tanning liquor of alum and salt and before they have been dried out, they are tacked out upon boards and plastered upon the flesh side with a paste of whiting. The whiting is simply mixed with water until a thick paste results and this is spread evenly over the skin. As the skin dries the whiting draws out the grease, which shows a dark leaden color through the paste. The coat of plaster should be scraped off and removed again and again until all the grease is fully absorbed. It is sometimes necessary to give five and even six applications of the paste before the grease is entirely removed. After becoming free from the grease, wash off the paste and apply to the flesh a mixture of two parts alum and three parts common salt. This may be in strong liquid form and should be applied two or three times. Then dry the pelts out and work them soft.

Woolskins are also very cheaply tanned in the following manner:

First the sheep pelt should be washed or soaked for a few hours in clean water, preferably warm, and then fleshed, by which all fleshy particles are removed from the inner or

flesh side and the loose dirt removed from the wool side. Next the pelt should be washed in warm soapsuds. For this the old-fashioned soft soap made from wood ashes is best, although any soap may be used. Rub the pelt either by hand in the soap suds or on a washboard. As soon as the pelt is clean rinse it in clean water, and press out as much of the water as possible. Then the following mixture should be prepared and applied to the flesh side. One-fourth ounce each of common salt and ground alum, and one-half ounce of borax dissolved in one quart of hot water. When sufficiently cool to work with the hands, add enough rye meal to make a thick paste. Spread the mixture on the flesh side, fold the pelt and let it lie for two weeks in a cool, moist place. Then wash the pelt in warm water so as to remove the paste. The pelt may now be dyed any shade or left the natural color, and when nearly dry the flesh side should be scraped with a dull knife and the skin worked until soft and pliable. Comb the wool when it is dry.

Another method somewhat speedier

And just as reliable as the foregoing is the following: For one sheepskin one pound of salt, half pound of alum, two tablespoonfuls of saltpetre. Soak the skin in clean water and then spread it out on a smooth surface. Rub the mixture well into the flesh side, turn the head to the tail, leaving the wool side out, roll smoothly and let it lie for four or five days. Then scrape the flesh and make it clean and wash the wool carefully with soapsuds so as to remove all grease and fatty matter. Work the pelt thoroughly while it is drying and it will finish up soft and pliable. The solution of salt and alum may also be made up in a tub or vat and the pelts left therein with occasional stirring for about two days, then dried out.

WOOL-WASHING SOAP.

A good soap, useful in washing wool and freeing it

of grease, can be best prepared from olive and cochineal oils. Seventeen hundred and sixty pounds of olive oil are boiled to a grain with caustic soda lye. After the soap has separated and the lye has been drawn off, nineteen hundred and sixty pounds of potash solution of 20° Bé. are added and allowed to boil a little. Now four hundred and forty pounds of cochineal oil are added, and when well taken up the same quantity of potash solution of 20° Bé. is gradually added as the soap can take it up.

A cheaper and less valuable soap commonly used for washing wool is also easy to prepare. Seventeen hundred and sixty pounds of elaine and four hundred and forty pounds of tallow are boiled to a grain, the precise method of boiling being immaterial provided a good firm grain is obtained. In another kettle a soda solution is prepared of 30° Bé. Now take 220 pounds of this soda solution, place it in a shallow kettle with 440 pounds of the grain soap, stir well and then add, with constant stirring, 220 pounds of dry soda. In this way a thick paste is obtained, which is allowed to cool in the pan and is removed after forty-eight hours with a chisel. This is broken up into small pieces of the size of an egg and is ready for use.

This is also a very satisfactory method of tanning sheepskins with wool on, shearlings, etc.

The skins should be well soaked in water and then fleshed. They are then laid on a table, flesh side down, and the wool washed thoroughly with a strong solution of soap and soda. When the wool is free from grease it is rinsed in pure warm water until it is perfectly clean. The tanning is then proceeded with by putting the skins into a tub and covering them with alum liquor, keeping them well stirred about so that the alum can penetrate every portion. For this from one to two days are required, the strength of the liquor being increased each ten or twelve hours. For this liquor a stock solution is first prepared by

dissolving thirty-three pounds of alum in sixty-five gallons of water and then adding about twenty pounds of salt. For the bath, as much of the alum and salt solution is used as will give the liquor a sharp salty taste. The exact quantity is a matter of small importance. The skins should be given plenty of room and not be crowded into the tub. When fully tanned they are laid over a beam and allowed to drain for some hours. When sufficiently dry they are laid in piles on a table, flesh side up, and are brushed over lightly with a fat-liquor, consisting of soap and oil, or soap and grease. If the skins are to be white they are hung in a tight chamber, or hogshead, and bleached with sulphur, and are then hung up and dried out. If they are to be dyed, aniline colors should be used, but the dye must be applied before the fat-liquoring. The most important requisite in dyeing the wool is that it should be free from grease. This may be accomplished by scouring the wool in a mixture of soft soap and water, to which a little soda has been added. The soda ash has a tendency of making the wool somewhat harsh, but the addition of a little salt will obviate this and also save the workman's hands from becoming sore in the liquor. Some bleaching effect is also obtained from the use of the salt. The wool must be thoroughly washed free from all the soap.

The best way to scour the alumed pelts

Is on a table. In this way the flesh side is protected somewhat from the water, and none of the alum is washed out. The wool is well scoured with the soap solution until every part is thoroughly cleansed, then it is thoroughly washed in clear water. When the wool is to be dyed black or dark colors it is not necessary that it should be perfectly clean. When light colors are wanted the wool should be bleached with sulphur fumes. A seal brown may be obtained with gambier, the skins being left in the liquor until they acquire

the desired shade. Then they are passed through a solution of bichromate of potash and then rinsed in cold water. They are then dried out, worked soft, and if it is required the flesh side is smoothed off on an emery wheel.

To accomplish the bleaching of sheep pelts, lambskins and goat-skins tanned with the wool and hair on,

The following method may be used: The tanned skins are first thoroughly washed in warm soapsuds, and then rinsed off in clear water. Four and one-half pounds of chloride of lime mixed with thorough stirring into twenty-one quarts of water. The mixture should be allowed to stand until it has settled. The clear liquor is then drawn off into a solution of ten and one-half quarts of water, in which have been dissolved five and one-half pounds of glauber salt. A precipitation results which leaves hypochlorite of soda in solution. The clear liquor, which should be quite free from lime, is then drawn off, and the skins immersed therein until they are thoroughly bleached, which takes about two days. When they are sufficiently bleached the skins should be washed out, and then washed in a solution of white oil soap in order to give them the necessary soft feel.

Permanganate of potash and bisulphite of soda may also be used for bleaching. The skins are washed and cleaned and then immersed in a bath of permanganate of potash made up in the proportions of one and one-tenth pounds of the potash in one hundred and thirty gallons of water heated to 95° F. In this solution the skins are worked for one hour, and at the end of this time they are removed and placed without rinsing in a bath of bisulphite of soda, made up of one-hundred and thirty gallons of warm water, seven and one-third quarts of bisulphite of soda, and six and five-eighths pounds of hydrochloric acid. In this liquor they are worked until they are sufficiently bleached.

CHAPTER V.

SHEEPSKINS.

BARK, EXTRACT AND CHAMOIS TANNING.

LARGE numbers of sheepskins are tanned in bark and extract liquors, and used as lining material. Various tannages are used in making this class of leather. Hemlock is largely used, also combinations of hemlock and other tans. When a combination liquor is used, one extract supplements the other. Palmetto extract makes soft, tough leather, well filled, and of good color. Being a rapid tanner it works well with slow tannages. A good method of using palmetto extract is in drums, sheepskins becoming thoroughly tanned with it inside of three hours. The coloring of the skins with the tannage may be begun in a paddle vat, and the tanning completed in a drum. A running for one hour in a paddle vat suffices to color the skins and to begin the tanning. After the tanning is completed the skins are washed, pressed, shaved and finished either with or without coloring. This tannage also works well with a chrome process.

When pickled skins are being tanned in bark or extract liquors, fairly weak liquors are used. The skins are left in the liquors simply long enough to become well colored and struck through, and are then dried out and finished. In the drying of this class of leather the skins are usually tacked on boards in moist condition and left thereon until they are dry.

The softness of the leather is generally produced by the nature of the tannage, and the smoothness and quality of the grain by the methods used in preparing the skins for tanning.

A dull finish is obtained by ironing or rolling the leather before it is quite dry, and in this way the grain is laid down smooth. Hot irons are used, and unless the workman is careful the iron may be too hot and burn the leather. Vegetable tanned skins cannot stand much heat; the grain becoming very brittle when too much is used and they readily crack and break in handling.

A combination tannage

Two-thirds of which is quebracho liquor and one-third hemlock liquor produces very good leather. The length of time consumed in tanning skins in this tannage is very short. The leather is well filled, soft and of good texture, while the color is light and uniform, and more satisfactory than the color of hemlock tanned leather after it is bleached. When colored leather is desired the tanned skins can be easily colored any shade by the use of aniline dyes.

Very excellent leather is made by combining a chrome and a vegetable tannage.

Gambier is often used to supplement the chrome tannage, but palmetto extract is better. The skins may be milled in a drum in palmetto liquor and then finished up in chrome, or they may be retanned in palmetto liquor after the chrome process is completed. The palmetto liquor serves to neutralize any acid in the leather, and also to serve as a mordant for any color or for black. In applying this process to a lot of chrome-tanned sheepskins the following proportions may be used: For one thousand pounds of chrome tanned skins one gallon of palmetto extract and a gill of glycerine in sufficient warm water at a temperature of 90° F., to either paddle the skins in or to drum them in a pin-mill drum. This method of tanning makes the leather more solid than the pure chrome tannage, and the grain does not peel.

For light colored leather it is always best for the tanner

to remove the acid from pickled skins before tanning them. While the skins tan readily in some liquors when they are full of acid, for leather of superior quality, fine clear grain and good color, the acid should be removed from the skins before they are tanned. A drench of whiting and salt may be used for the purpose, also a drench of sour bran and salt. The pickled skins after being softened in salt water may also be given the bath of whiting and salt, and then left for a few minutes in the liquor of bran and salt.

Palmetto extract may be used in combination with quebracho, also with hemlock; in fact it works well with any tannage. However, the combination of quebracho and hemlock is, of all processes, really the most desirable. For lining purposes the skins may be left in the natural color of the tannage, and when colored leather is wanted they may readily be colored any shade. Sheepskins tanned by any vegetable process or combination process may be bleached by the methods described in another part of this book.

THE COLORING AND FINISHING OF VEGETABLE TANNED SKINS.

Sheepskins that have been tanned in a vegetable tannage such as bark, sumac, gambier and similar tannages are usually dried out after tanning and before they are colored. When they are to be colored they require a moistening and washing before they are colored in order to remove from them all dirt, dust, and particles of tannin that have not combined with the leather. At the same time the washing serves to moisten and soften the skins and thus to put them in the right condition to receive the mordants and dyes. When the washing is properly done the shades are made clear, full and deep. When the dried skins are immersed in the dye bath without sufficient washing many defects will be noticed in the finished leather. The color cannot penetrate nor combine with the fibres and the result in coloring is decidedly unsatisfactory.

The dry skins may be moistened in a tub and left in piles for some hours until they have become sufficiently soft, or they may be moistened in pin-mill drums. The water used for this work should be soft and warm, as such water has much greater softening and cleansing powers than cold or hard water. A safe temperature is from eighty-five to ninety-five degrees. To some extent the amount of treatment required by a lot of skins to bring them into the required condition depends upon the character of the skins and the nature of the tannage. Very light skins that have been tanned in a soft tannage require very little treatment, but very careful handling, while heavy and firmer tanned skins demand a much more thorough preparation.

The use of hard water

Has the effect of causing a faded and dingy appearance to the shades of color, and when such water is used in dissolving aniline dyes it often happens that a portion of the dyestuff settles to the bottom of the vessel in the form of a soft mass. This causes imperfect coloring. It is also imperative that the water be clean and free from dirt and other foreign substances. The evil effects of hard water may be prevented and such water rendered suitable for coloring purposes by adding to it a small quantity of acetic acid. Borax is also used and helps in giving a soft feel to the leather. The quantity of borax required depends upon the condition of the water, but as a general thing one-half pound is enough for one hundred gallons of water, dissolved in a separate vessel and poured into the water to be used for coloring.

A very important element that is often overlooked is cleanliness. Every vessel or utensil used should be perfectly clean and free from foreign matter. A very small quantity of foreign matter causes a change in the dyestuff, especially when aniline colors are used. When brushes are used they should be kept clean and a separate brush

used for each liquor used. Too much care cannot be taken in this particular. All tables and cloths used by the dyer should be kept clean.

Skins that have acquired a dark shade

From the tannage should be given the dark shades of dye. When lighter shades are wanted the leather must be toned down or bleached. One of the most common methods is to draw the leather several times through a warm sumac liquor, or they may be left in such liquor several hours or drummed in it in a drum. Some of the tannins in general use contain quantities of coloring matter, and these exert an influence upon the colors. Sumac contains very little coloring matter, and is, therefore, commonly used in tanning skins intended for light shades. In some instances when the color of the leather is dark to begin with, advantage may be taken of the color and less dye materials used.

Lactic acid is a very good article to use in coloring sheepskins.

It not only serves the purpose of cleaning the leather of grease, but also acts as a mordant when used in connection with bichromate of potash. In fifty gallons of warm water dissolve two pounds of bichromate of potash and one-half gallon of lactic acid. The liquor is used as a mordant and as a striker. On light colors it is preferable to use it at the end of the dyeing operation as a striker and evener. In the case of dark colors such as chocolates, browns, dark tans, etc., it may be used in preparing the leather for the colors. The skins should be uniformly moistened and softened with water, and then milled in a solution of lactic acid, about one gallon to fifty gallons of warm water, for thirty minutes. It is generally necessary to wash the skins off in warm water before coloring when the basic or sweet aniline dyes are used, but when sour anilines are used no washing is required, the skins receiving the dye immediately after the acid treatment. By first milling the skins in an acid liquor, dyers are enabled to get clearer and more uniform

colors, as this operation not only clears the grain of greasy matter, but also opens it up, thus allowing deeper penetration of the dyestuff. For some dark colors it is wise to use a solution of the acid solution, then to follow it with the color solution and to strike with copperas.

Sorting the skins.

Before the work of coloring is begun, the skins should be sorted according to texture and weight. All skins of firm and dense substance should be sorted out from the loose, light and open-grained skins, and each class colored separately. The clear and fine-grained skins should be given the fancy shades, and the skins that show any defects or imperfections given the dark shades. Some small defects that might not appear on dark-colored leather are often plainly seen on light shades. The more serious the defect the darker should be the shade given.

Applying the dye and finishing the leather.

It is a good plan to have a sufficient number of skins tanned and dried ahead, so that they can lie in the dry state some time before they are colored. The longer they lie in the dry state the better will be the final result. After the coloring process is finished, the skins should be finished as soon as possible. The finishing processes frequently change the shade of the leather, and it is therefore very important that the dyer knows just how much dye a lot of skins need in order for them to come through the right shade. Various methods may be employed. The leather may be brush-dyed on tables, passed through dye-boxes or treated in drums. When the coloring is done on tables, the skins are spread out grain side up and struck out with a slicker so that they lie perfectly smooth. After the right shade is obtained the leather is washed off and dried out. Soft sponges fastened to handles may be used instead of brushes. When the coloring is done in paddle-vats the skins are paddled for twenty minutes in each of the liquors

used, enough of each being used to enable the skins to float and turn in the liquor. More water is of course required, and more time consumed by this method than when drums are used. When the leather is dyed in drums the skins should first be drummed in the clearing or mordanting liquor and then for the same length of time in the color and striking liquors, after which they are washed off and finished. The leather should be dried out in a darkened room. When it is hung in a strong light the color frequently fades. The temperature of the room should be maintained at a uniform degree, and the leather dried rapidly, but not so rapidly as to parch it. Many of the troubles encountered by dyers in coloring leathers are the result of improper methods of handling the skins in the processes that come before the coloring. Much can be gained by giving these processes close and careful attention.

Before coloring the leather with aniline dyes

It is good practice, after it has been moistened and washed, to drum it in a warm sumac liquor. This serves to freshen up the stock and for it readily to receive the dye liquor. For medium and large sheepskins it usually requires about four ounces of the liquid extract of sumac in sufficient water to cover the skins. In this liquor the skins are drummed for twenty minutes. Then is applied to the same bath two ounces per dozen of antimonine and the drumming continued for fifteen or twenty minutes longer. After this the skins are rinsed off in warm water and the coloring bath prepared. From two to three ounces of aniline dye are usually required for each dozen skins at a temperature of one hundred degrees. After coloring the leather is washed off and dried out. The use of the antimonine is for the purpose of cleaning the grain of the leather, overcoming the uncombined tannin and fixing the dye upon the fibre, so that nothing further is needed to set the colors. In place of sumac, fustic may be used when it is considered necessary

to use a mordant. Usually, however, this class of leather, that is to say bark and extract tanned sheepskins, requires no mordant, as the tannic acid in the tannage serves the purpose of a mordant. Vegetable-tanned skins are colored a large variety of shades.

Desirable shades.

Some of the most desirable of the shades are ox-blood or wine color, chocolate, tans, browns and greens. For the ox-blood shade about three ounces of the aniline amaranth, 3/R, for each dozen skins are used. For a desirable chocolate shade, for each dozen skins from two and one-half to three ounces of aniline chocolate brown 270, produces the right results. The leather is first cleared of grease and then the dye applied. The drum method is usually preferred as it produces the most uniform coloring. By mixing an amaranth or ox-blood shade with a chocolate-brown, a dark and very desirable shade of ox-blood is produced. The temperature of the drum should be maintained during the process of coloring at ninety to one hundred degrees Fah. The dyes should be thoroughly boiled and then cooled down to the right temperature before they are used. To insure even coloring the skins must be kept in motion while the color solution is being added to them.

For a desirable shade of green

Apply to the skins; after they have been washed and softened, two ounces of antimonine for each dozen skins, and follow this with three ounces of leather green, or of dark green, M, and one ounce of amaranth. Bark and gambier-tanned skins should be freshened up in sumac before the antimonine is added. The skins may also be colored by being drummed in a solution of bichromate of potash, made up of one ounce of potash in three gallons of warm water for each dozen skins, and this is followed by the aniline dye. Finally, there are added to the skins one ounce

of bichromate of potash and one-half ounce copperas, and the skins are drummed fifteen minutes longer.

In dyeing bark tanned leather black

Logwood is generally used in connection with an iron liquor or striker. To fifty gallons of water about five pounds of logwood product in powder form and one pound of sal soda are added and boiled. The moistened skins may be drummed in this liquor until the color is well taken up, then they are spread upon a table and the striker applied to the grain. A good striker may be made of fifteen pounds of copperas and five pounds of blue vitriol boiled in fifty gallons of water. It is not usually necessary to clear the grain of vegetable-tanned sheepskins before they are blacked, as the sal soda serves to carry the dye into the leather. A good method to employ in drying out the skins is to tack them upon boards in the moist condition and to leave them until they have become dry. As much as possible of the natural grease should be gotten rid of. This is usually accomplished by pressing the raw skins in a hydraulic press or by treatment with naphtha after liming. Sometimes it is necessary to again degrease the skins after they have been tanned in a process of naphtha.

A good black

On bark and extract tanned sheepskins can be obtained by the use of a liquor composed of logwood and fustic extracts, a very small quantity of the latter being sufficient to intensify the logwood black. The leather is first moistened with water until it is uniformly soft and moist; then it is treated to the logwood and fustic liquor, which should be applied warm and well brushed into the grain. This is followed by an application of copperas and blue vitriol liquor, or an iron or vinegar striker. The leather is given two coats of the liquors and is then washed off. To increase the softness of the leather the skins, after dyeing, are rubbed over with oil, or with a mixture of egg-yolk and glycerine.

SKIVERS.

A skiver is the grain side of a split sheepskin. In making this class of leather, the skins are split in the beam house, and the flesh or inner side is worked into glove or chamois leather, and the grain side is tanned in bark, extract or alum processes and used for a large variety of purposes—principally in the manufacture of leather goods such as pocket books, belts and suspenders, as trimmings and linings. Skivers are also used in large quantities as hat or sweat bands. Being of very light substance, and possessing very little strength of fibre, a great deal of care is required in handling this class of goods during the processes of tanning, coloring and finishing.

The splitting is usually done after the skins have been limed. On account of the fact that skivers are often finished in very light and fancy colors, it is highly important that the liming, drenching and other beam house processes are done in a very thorough and cleanly manner, in order to keep the stock clean and free from shaded or mottled grain.

After the splitting has been done the grains receive a thorough drenching in a bran drench. This, of course, is for the purpose of washing out the lime and bringing the grains into the right condition for pickling and tanning.

A good drench

Suitable for this class of goods may be made of bran as follows: One-half of a barrel of bran is mixed into enough water to make a thick mush. This is covered up and let stand for forty-eight hours, until it has become thoroughly sour. Then it is poured into the tub or vat to be used for the work and mixed with enough warm water to cover the number of skins. This quantity of bran will answer for six hundred skivers. To the drench should be added three pints of sulphuric acid and three pecks of common salt, and the prepared drench heated to about ninety degrees. The skivers are stirred carefully about in this drench for a

sufficient length of time to thoroughly cleanse them of the lime. Two or three hours is usually sufficient. After drenching for this length of time the grains will be found to be clean and free from dirt and lime. For light colors it is usually a good plan to wash them again before pickling them, in order to still further cleanse them ; but in many instances this is not necessary, the pickling process serving to clean and bleach them. The bran should be carefully selected, as bran that has been once damp is unsuited for the purpose. Another method of using the bran drench is to allow the fermentation to take place while the skins are in the liquor. The same quantity of bran is used as when the fermentation takes place before it is used. About one-half of the bran is added to the warm water in the vat, and while it is being well stirred, one-half of the grains are put in, then the balance of the bran is added, and then the remaining skins. It takes some time for the fermentation to commence ; and as the drench sours the skivers are forced up on the top of the liquor. They need to be kept down until they have become perfectly soft and clean, after which they may be washed in warm water and pickled. A good pickle for two hundred grains may be made of two and one-half quarts of acid, fifty or sixty pounds of salt in one hundred gallons of water. The grains should be stirred carefully in this liquor for about one hour, and then removed, and can then be kept indefinitely without spoiling. They may also be tanned without pickling.

Various materials are used in tanning skivers.

Any tannage that works well upon sheepskins may be used. Sumac is, perhaps, the most frequently used. Bark tannages are also employed, also alum and chrome processes, the last two methods imparting more strength to the fibres than either bark or sumac. During the tanning the stock must be handled carefully to prevent tearing. By suspend-

ing the skivers in the liquor, all danger of tearing is obviated, a smooth colored grain is assured and a very uniform tannage results.

For a common grade of leather

Pickled skins may be tanned in hemlock liquors. Very little tanning is necessary, getting the stock well colored and struck through is all that is required. Sumac liquors are usually made up warm and either the extract of sumac or the sumac leaves may be used. The tanning consumes but a few hours, and when completed, the skins are washed off in water to remove surplus sumac, pressed and dried out. Sumac is so liable to ferment that a new liquor should be used for each lot of grains. When alum and salt are used, or a chrome process, the tanning is completed in less than one hour, when a drum is used, this method of tanning being very liable to tear the stock seriously, tanning in vats is better. Chrome-tanned skins must be colored before they are dried out. Upon coming from the tanning liquors they should be washed and prepared for coloring by being given a sumac bath. A white soft leather is made by taking the skins from the sumac bath and drying them out without coloring. The sumac makes an excellent mordant for any shade of color.

Sumac-tanned skins, after drying out, are moistened and colored. They are usually box-colored, that is, dyed in trays or dye boxes. They are folded lengthwise through the center and dipped in the color solution until the desired shade is obtained, then the color is set by the application of a weak solution of bichromate of potash, the skins washed off and dried out again. Chrome-tanned skins are colored in the same way, the only difference being that they are not dried out at all until they have been colored. In the working of the stock after drying great care is necessary to prevent tearing. The skins being hard and having shrunk in dyeing, must be moistened and left in piles

for a few hours. Then they are crutched, and as much of the pulling and working as can be done by hand should be done in this way, as the skins stand very little rough usage.

Skivers are finished in numerous ways.

They are glazed smooth, finished in dull, and also glazed and by use of embossing machines are finished into imitations of alligator, seal and pigskin. The rolls used for embossing are made of steel, upon which the desired figures are cut; the skins are passed through the machine and come through with the figure wanted upon them. By the use of aniline and sulfamine dyes and the embossing machine many beautiful and novel effects are produced. Aniline dyes have a special value for the maker of this class of leather, because of their brilliancy and beauty and because of the almost unlimited number and variety of shades that can be produced with them. Many new shades can be obtained by a combination of two or more dyes. Upon sumac tanned skins, and upon skins treated with sumac as a mordant, aniline dyes produce splendid results, being rapidly absorbed by the leather. What has been written about aniline dyes applies equally well to sulfamine dyes.

A good process of tanning.

Perhaps as good a process of tanning as the tanner of skins can use is a mixture of quebracho and hemlock extracts, made up of two-thirds quebracho and one-third hemlock. This tannage produces a very light color that is uniform and clear. The skins tanned in this way may be colored any fancy shade desired, and they may also be bleached by the methods of bleaching described further on. For most purposes, however, skins tanned in the combination of quebracho and hemlock require no bleaching, as the color produced by the tannage is sufficiently light and uniform.

CHAMOIS LEATHER.

Chamois leather at the present time is made almost exclusively from sheepskins. The leather is produced by the action of oil upon the raw skins, and is distinguished from all other classes of leather by remarkable softness and open texture. In the making of this leather the wool is removed from the pelts in the usual way, then the skins are limed long and thoroughly in order to make them very soft and elastic. The skins are then split on a machine adapted to the work, the grain being tanned and finished into fancy leather, while the flesh side is oil-tanned into chamois leather. After splitting, the flesh sides receive a further liming in order to increase their softness and porosity. Old lime liquors, provided they are kept clean, produce the best results, as they make the fibres of the skins very soft and silky without the hardness that comes from the use of new, fresh limes.

Removing the lime.

To remove the lime from the skins they are subjected to different processes. In some instances they are bated with manures and then given a bran drench, which leaves them perfectly clean and very soft. Some manufacturers remove the lime by thorough washing and without subjecting the skins to a fermented bate at all. This method makes the leather more durable than when a bating process is used. It is very important that all the lime be gotten rid of before the skins are treated with oil.

Treatment of the skins.

Before the skins are tanned they are pressed in a hydraulic press in order to get rid of all surplus water and to make the skins as dry as possible. They are then given a thorough beating in machinery especially constructed for the purpose, in order to soften them, after which they are sprinkled with cod-liver oil and are again beaten in order

to force the oil into the leather. The best grade of Newfoundland cod oil is considered the best for the purpose. The process of oiling the skins and beating them is repeated two or three times, or until they have lost their original smell of lime and have acquired a mustard color. After the oiling and beating process is completed the skins are made to undergo a process of heating. By this process the oxidation of the oil which commenced during the previous process is completed by the fermentation that results, in the skins. The heat is generated spontaneously. The skins must be watched very closely and frequently turned over. When the heat rises to a high temperature the leather is seriously damaged. The heat that is generated destroys all organic matter in the skins. The highest temperature allowable is 140 degrees F. This heating process is a most delicate operation, and upon its being properly done depends the success of the leather. When insufficient heat is generated the leather rots, when too much heat is produced it becomes dissolved. When the fermentation ceases, and the skins are no longer susceptible to heating, they are treated in order to remove the oil. This is done by washing the skins in hot water and then pressing them under a hydraulic press. The grease that is squeezed out in this way is *degras*, an article largely used by tanners. The oil may also be removed by washing the skins in a solution of soda ash, which causes the grease remaining to saponify. This saponified oil is then neutralized with sulphuric acid and forms the oil known as *sod oil*. A certain percentage of the oil should be allowed to remain in the skins so as to give them softness.

The finishing processes consist of drying, staking, and smoothing down all unevenness on the surface. The skins may be bleached by being sprinkled with water and exposed to the sun, or by treatment with a weak solution of permanganate of potash, followed by a treatment with diluted sulphuric acid, or the leather may be treated with sulphurous

acid in the form of gas. Methods of treating the skins vary. In some instances the skins, instead of being laid in piles to ferment, are hung up in warm ovens, which is less dangerous and produces a better color. Very soft, tough leather having many of the characteristics of chamois leather is made from fleshers in chrome tanning. The skins may be tanned in the usual way and then very heavily fat-liquored with emulsions of oil, egg-yolk and soap, or of oil and degreas. By first treating the fleshers to a tawing paste of alum, salt, flour and egg-yolk, made up in the proportions of nine pounds of alum, four pounds of salt, twenty pounds of wheat flour, and twelve pounds of egg-yolk, for one hundred pounds of skins, and drumming the skins in this liquor in a drum at a temperature of ninety degrees for twenty minutes, and then drying them out, and after lying in the dry state for some weeks working them soft, a very soft and elastic leather is produced. They may be finished up with no further treatment other than working and smoothing, or they may be subsequently tanned in a chrome process and then finished.

Chamois leather may also be made

By passing the prepared skins (washed and pressed) through a twenty-five per cent. Turkey-red oil solution. After this they are dried and laid in a moderately warmed room in a heap and covered up. They are then hung up in the air and allowed to dry slowly, when they are again oiled in the same solution and again laid in a heap, again dried, and then washed in a weak solution of alkali.

By drying and working, the leather is made soft and completely oil-tanned. The results may be variously modified by greater or less concentration of the oil solution, by higher temperature in drying and by more frequent applications or treatments with the oil. Combinations with the salts of alumina may also be employed here. The preferred method is as follows: The prepared skins are steeped in a

solution containing preferably fifteen per cent. of the soluble Turkey-red oil, then they are dried and the operation repeated, then the usual method of tanning is proceeded with in the usual way.

CHAPTER VI.

GOATSKINS.

BEAMHOUSE WORK. PREPARING THE SKINS FOR TANNING.

GOATSKINS in the hair are received by the tanner either in dry or dry-salted condition. The ends and objects to be accomplished during the soaking and softening process, the first through which the skins are worked, are thorough softening and freshening up of the skins and the removal from them of dried blood, dirt, dust and salt. Good results cannot be obtained in the liming process unless the skins are thoroughly softened and cleansed at the beginning.

Dry-salted skins need to be freed of all the salt upon and in them before they are limed. Such skins should be soaked for a few hours in clean, fresh water, then worked mechanically and put back into clean water for some hours longer. The water should be frequently changed and not allowed to become foul nor full of salt. Dried skins are somewhat difficult to soften, and require a more thorough soaking than salted skins, because having been dried in the raw state they are almost waterproof and resist the penetration of the water. Such skins are softened with clean water with considerable difficulty, and are sometimes affected in quality by injudicious soaking.

In order to hasten the soaking and softening, solutions of chemicals are used to good advantage. Borax, sulphide of sodium and sal soda are frequently used. Borax is the most expensive of the three articles. When it is employed, from two to five pounds are used for each one thousand gallons of water. It should be dissolved in a separate vessel and poured into the soak-water and well stirred throughout the

same. Sulphide of sodium may be used in the same manner. This article thoroughly softens the dry skins and brings the withered grain and fibres back to a soft, fresh condition in a short time.

Boracic acid is also used in the soaking process, as it assists in the softening, and being an antiseptic, prevents, to some extent, any injury to the skins caused by decomposition.

The serious danger in connection with the soaking process is the liability to putrefaction. This may be guarded against by the use of the articles mentioned and by keeping the soak vats clean by frequent changes of water. Some tanners of dried skins use old stale soaks in which they soften their skins. Such soaks certainly soften the skin in a short time, but often at the expense of the stock. The putrefaction that is constantly going on in such soaks frequently causes the grain of the leather to become shaded and clouded. This defect is especially undesirable when the leather is dyed fancy, light shades. Improper methods of soaking also frequently cause a pricked or pitted grain. A good rule to observe is to leave the skins for about twenty-four hours in the first soak, then to pull them out, and after the dirty, salty water has drained off to put them back into another clean, fresh soak to which some borax or sulphide of sodium has been added, in which the softening is completed.

When the softened skins have been removed from the soak vats and before they are passed into the depilating process, they are frequently piled in heaps. Heating frequently sets in, especially in warm weather, and in a short time serious damage will result. When this occurs it is necessary to expose the skins to the air at once or they will be completely destroyed. Heating always injures the skins more or less according to the degree of heat developed, and it is therefore very important that it be guarded against as much as possible. The skin piles should be frequently

handled, or better still, no delay should take place, but the skins passed at once into the following process. In all beam-house processes it is good practice to handle the stock promptly. Goatskins require a soaking of about forty-eight hours, depending upon their condition and thickness and the temperature of the water. Good judgment must be used as in all other tanning processes and will go further towards getting good results than any set rule. It is certainly important that the skins are thoroughly softened before they go into the liming process. The cleaner and softer a skin is when it goes into the unhairing process the clearer and brighter will be the grain of the finished leather.

THE LIMING PROCESS.

The office of any material used upon raw skins in preparing them for tanning into leather is to swell and distend the fibres of the skins, thus loosening the hair roots and enabling the tanner to readily remove the hair; then to dissolve the perishable animal matter in the skins so that it can be readily removed before tanning. When this has been done, soft, pliable leather can be made, and not before. Various materials are used and different methods are followed in the manner of using them according to the kind of skins being worked and the class of leather to be made from them. For many years the only depilant in general use was lime. Its use, however, unless combined with some other article, has many objections. Red arsenic has long been used in connection with lime, and is used at the present time very extensively in the tanning or making of goat leathers. When combined with lime it produces leather with a very fine, elastic grain and of soft, fine texture.

In preparing a new lime with red arsenic, one hundred pounds of lime are slacked with about twelve pails of hot water. To this quantity of lime are added about five pounds of the arsenic. It may be dissolved separately and then mixed with the lime. Both materials should be thoroughly

dissolved before they come in contact with the skins. A common practice is to lime twelve hundred skins at one time. No exact rule is generally followed in regard to the quantity of lime used nor to the length of time consumed by the unhairing process. The quantities of lime and red arsenic mentioned are enough for six hundred goatskins to begin with. After they have been in the liquor for one day they are drawn out of the lime and the liquor well stirred up in the vat. If the skins are allowed to drain before they are put back they will absorb the lime again more readily. When paddle-vats are used it is not necessary to pull the skins out, although the lime should be stirred up from the bottom daily. On the third day the liquor should be strengthened by the addition of two pails of lime. The strength at the beginning should be about three degrees Twaddle, and by the daily addition of lime and arsenic it should be gradually increased to about six degrees. These points are not arbitrary, although safe to work by. When too much lime is used towards the end of the process the grain sometimes becomes rough. This needs to be overcome during the process of drenching or purging. The best results usually follow the use of limes that have been used before. A good lime may be prepared in this way by using about two-thirds old liquor and one-third new—that is, of six feet of liming liquor in the vat four feet may be old and two feet may be new and fresh.

After the hair becomes loosened it is best to leave the skins in the lime for a day or two longer, as this not only enables the hair to come off more readily, but makes the leather more supple. The use of red arsenic and sulphide of sodium in conjunction with lime not only shortens the time required to prepare the skins for tanning, but also keeps the grain from becoming rough, makes a softer, more durable leather, as well as makes the lime more soluble, and therefore more easily removed before tanning.

Very good results are obtained from the use of sulphide of sodium and lime.

There are various methods of using sulphide of sodium. It can be used alone and applied to the flesh side of the skins, and the skins may be left for a few days in a solution of sulphide of sodium, or the sulphide of sodium may be mixed with lime. When sulphide of sodium is used alone and no lime whatever used, the resulting leather is somewhat hard and close, showing that something more than removal of the hair must be accomplished before good leather can be made. Sulphide of sodium is very simple to use, besides producing far better leather than the older methods of unhairing. No great harm comes to the stock by using the sulphide too strong; the material is merely wasted. It is important that the sulphide of sodium be of good quality and free from dirt, iron or sediment. The material should be dissolved with boiling water slowly, and well stirred up and not allowed to settle. It should not be used warm but should be dissolved long enough beforehand to enable it to become cool before it is used. The strength at which it is used varies slightly according to the kind of skins to be treated. In all cases the strength need never be greater than just sufficient to start the hair.

When it is desirable to save the hair, it is good practice to paint the skins upon the flesh side with either a clear solution of sulphide of sodium or a mixture of sulphide of sodium and lime. When this is done the skins require to be thoroughly softened and freed of all salt and dirt, either by draining or extracting before they are treated. The skins are spread upon a smooth table and the depilatory solution or mixture is applied to the flesh side. The liquor is put on by means of a vegetable fibre brush or swab of burlap, and only enough liquor is put on to cover the skin without running off. To prevent sore hands, the workman must wear rubber gloves. After painting, the skins are folded up and placed in piles. If any of the sulphide or

sodium comes in contact with the hair it dissolves and destroys it at once. In cold weather eight to ten skins may be placed in a pile together, but in warm weather not more than four or five to prevent heating, and if they are to lie for twenty-four hours or longer they should be singled out so that one may lie on the next. The painting should be done in a cool, moist room. In summer care must be taken that the skins do not get warm, and in winter that they do not get frozen. The hair will be loosened in a few hours but it is best not to unhair the skins until the next day as the hair will then come off more readily and cleanly. Very young and tender skins should be unhaired as soon as the hair starts and immediately put into clean, cold water. After the hair has been removed the skins should be opened flesh side out and immediately put into clean, cold water in which they will be safe from heating or spoiling for some time. No skin treated with sulphide of sodium will be injured so long as the grain is kept moist and not allowed to dry out and harden.

When lime is mixed with the sulphide of sodium

It should be thoroughly reduced to milk of lime by complete slacking before it is used. Hot water is best to use for slacking, and the lime should be stirred from the time the lime and water are brought together until all is dissolved. Too much care cannot be taken in this particular. Very often injury is done to skins by particles of unslacked lime. About one-third of a barrel of lime should be slacked in twenty-five gallons of hot water, and after the solution becomes cool it should be used at the consistency of thin paste. Several pails of this lime may be mixed with a barrel of sulphide of sodium liquor of a strength of about eighteen degrees. When it is mixed with lime the sulphide of sodium enters into chemical combination with the lime, forming various mixed sulphides that have a very energetic action upon the skins. The mixture does not swell the

skins to the same extent that lime alone does. At the same time it toughens the grain and fibre and helps in making a fine-textured leather. The mixture of lime and sulphide of sodium is applied to the skins in the same manner as the liquor made from the latter alone. When no value is placed upon the hair, the skins may be satisfactorily depilated by being left for a few days in a solution of sulphide of sodium in a vat.

To each one hundred gallons of water from ten to fifteen pounds of the sulphide of sodium are dissolved and poured into the vat and the solution thoroughly stirred. The skins are placed in this liquor and left therein for from twelve to twenty-four hours, or until the hair is reduced to pulp and can be readily washed off. They are then removed, washed off and limed. When this method is used it is not so important that the skins are thoroughly softened before going into the solution, as they may be left in the liquor for forty-eight hours if necessary until they are thoroughly softened and plumped. These methods of preparing goatskins are not in general use, the arsenic-lime process being the most commonly used. They produce good results, however, and are used when it is not considered desirable to save the hair. No matter which method of using sulphide of sodium is used, it should be borne in mind that the stronger the solution is and the longer the skins remain in the solution, and the less the depilatory is washed out after depilating and before liming, the weaker and less liming is necessary. The sulphide of sodium softens the skins and removes all scurf and filth, also the short, fine hair commonly called the undergrowth. By its use, too, the time of liming is considerably shortened.

While sulphide of sodium is an excellent unhairing agent, the mere removal of the hair is not all that must be accomplished before soft, elastic leather can be made. The skins, after the hair has been removed from them, must be further plumped in order to accomplish the dissolution

of the animal matter in them. Lime not only does this, but it unites with the fatty matter in the skins and saponifies it so that it can be readily removed from the skins before they are tanned. Many good tanners use what are sometimes called gathering limes. These are good only so long as they are kept clean and sweet. When limes are used over and over, they should be strengthened and renewed with fresh lime daily. When this is not done, and the lime liquors are allowed to become stale and dirty, the grain of the finished leather will never be bright and clear. The swelling property of a lime liquor decreases as it grows old, while the solvent action of an old and a fresh lime is about the same.

After the sulphide of sodium has been used upon the skins and the hair has been removed they go into the first lime. This may be half renewed for each pack of skins by running out about one-half of the liquor and replacing it with new, fresh liquor. When it is necessary to make a new lime, about two pailfuls of lime are slacked in one-third of a barrel of hot water. This is poured into the water in the vat and will answer for three to four hundred skins, according to their size and thickness. This first lime should always be kept clean and fresh, and should not be used too long. In summer it should not be used more than three times; in winter it may be used twice as long. The skins or slats may remain in this lime for one day, then be hauled out and more lime, in quantity the same as first put in, may be added, or the skins may be put into another and stronger lime. Upon the third day the skins are again hauled out and more lime added, and the lime-grounds thoroughly stirred up from the bottom of the vat. From four to six days liming, after treatment with sulphide of sodium, is enough for goatskins. If they are to be tanned without pickling, a little more lime may be used and will do no harm.

When paddle-vats are used for the liming process, the

skins are kept in motion and it is not necessary to pull them out each day. The liming will also be accomplished in less time than when still limes are used. Very light skins need to be limed not longer than three or four days. In all cases the best results are gotten when the skins are entered into a weak lime at first and the lime gradually strengthened. When vat room is scarce, it is good practice to haul the skins out of the lime at the end of about four days and to let them lie in piles for a few days. They should be protected from the air and not allowed to become dry or hard upon the edges. Some tannages, principally the chrome tannages, produce little or no plumpness in the leather, and for this reason the skins need to be handled in the beam-house in such a manner as to guard against loss of fullness and substance as much as possible. This is done by short, quick liming.

When sulphide of sodium is mixed with the lime in the vats and the unhairing and preparing of the skins are done at the same time, about one-third as much sulphide of sodium as lime is used. Both are slacked together and poured into the water in the vat. The strength of the first lime may be about three degrees, and by the addition of fresh lime each day the strength is raised to about six degrees. When this method is used, from six to eight days is long enough to lime light skins and from eight to ten days for heavy skins. After liming, the skins are washed in clean water in order to remove from them as much of the lime as possible, then trimmed, short-haired, and are then ready for the pure or drench. The fleshing is generally done immediately after liming. This work is generally done upon machines, although some hand labor is still employed.

THE BATING OR PURING OF GOATSKINS.

The next step in the manufacture of goat leathers is the process commonly called bating or puring, by means of which the skins are put into a neutral condition—that

is, freed from all lime and alkaline sulphides used in the previous process of depilating, and are put into a clean and pure condition to receive the tanning materials, vegetable or mineral. No lime should be left in the skins when a soft, fine-grained leather is wanted. When skins containing lime, even in a small quantity, are tanned by the chrome process, the lime is changed to sulphate of lime, which closes the pores of the skins, shrinking them and producing a rough, harsh grain and a close, hard leather.

The essential qualities of goat leather at the present time

Are softness, some elasticity, and a smooth, strong and silky grain. These qualities are produced by the methods used in unhairing the skins, as well as by the methods used in puring and drenching them. The quality and texture of finished leather are largely influenced by the methods employed in this part of the work; and for these reasons this process has always been an interesting and important one to tanners. The number of materials used to accomplish the objects of this process is limited and there is opportunity for improvement.

When it is desirable to have the leather very soft and elastic, the skins are given a long and thorough liming and a bating in such a manner that not only the lime is entirely removed, but also a portion of the substance of the skins, thus causing the fibres to work readily over each other and the leather to be soft and stretchy. The longer the skins are limed the more thoroughly will the substance be dissolved, and when the dissolved substance is removed before tanning very soft leather results. Lime has two distinct actions upon raw skins. Not only does it swell and split up the fibres so that the roots of the hair become loosened and easily removed, but it also reduces to liquid form portions of the skin substance that are removed by the process of bating.

In the preparation of goatskins the use of lime alone

makes the skins hard and lacking in those important qualities that have made goat leather so popular. By the use of red arsenic the grain is made soft and fine and the leather supple and elastic. When the proper proportions are not kept up the leather finishes up hard and tinny. The bating or puring process serves to remove not only the lime but also the dissolved substance, albumen, etc. During this process, too, the skins lose their plump and swollen condition acquired during the liming process and become soft and thin, and readily receptive to the tanning materials.

BATES AND BATING.

To accomplish these results upon goatskins, hen, pigeon and dog dung have been used for many years. While their use is unpleasant in the extreme and attended by many dangers and uncertainties, they produce upon the hard goat-skin results that no other materials seem capable of producing, and they continue in use despite all attempts to displace them with other articles. Upon calf, sheep and kangaroo skins and hides and kips other simpler, cheaper and safer articles are being used, that produce the right results, but upon goatskins nothing has yet been practically employed, to any extent, to act as a substitute for manures. Both bird and dog dung are used. The bird dung is very rapid in its action and makes the skins very soft and silky, and tough but somewhat lacking in elasticity. On the other hand dog dung has a very great softening effect upon the skins and unless carefully used the leather becomes hollow and flat with a great deal of spring to it. Chicken manure, to which some dog manure has been added, is largely used, being of greater strength than either when used alone. Chicken manure varies greatly according to what the fowls have been fed upon. The best results are obtained when the material is gathered while it is fresh and dried for future use. It should be kept spread out upon a dry floor to prevent its heating. The efficacy of the manure bate

depends upon the fermentive action developed. For this reason the material needs to be allowed to thoroughly ferment before it is used. The material may be prepared by using one and one-half bushels of dung in one-half of a barrel of water. By the aid of steam the temperature is raised to boiling point. The mixture is then thoroughly stirred until all lumps are broken up, then the barrel is covered up and the material allowed to ferment. It is important that the fermentation be fully developed before the skins are left for any length of time in the liquor. The water used should be clean, soft water. A paddle-wheel or vat is filled with the necessary quantity of water heated to a temperature of 90 degrees Fah. In order to avoid stains and burns caused by masses of undissolved excrement resting upon the grain or lying between the skins, the material should be strained through a piece of burlap or coarse cloth. The fermented bate is mixed throughout the water and the skins are entered into the liquor. By the action of the paddles the skins are kept in constant motion and the results are thus uniform. The stock requires to be left in this liquor until such time as the lime has become thoroughly neutralized and the skins reduced from their firm, swollen condition to one of softness and the grain has acquired a smooth and silky feeling. By drawing the thumb and forefinger across the body portion of a skin the condition of the stock can be ascertained, and it can also be plainly noticed when the indentation of the finger remains upon the grain. No exact length of time can be followed. The skins require to be bated in this way until they have become soft and white, and this must and can only be decided by the operator.

Some disturbing influences in bating.

For this reason, and for many other disturbing influences over which the operator has no control, the use of the dung bate is decidedly dangerous and uncertain. Constant

attention must be given to the stock, and even when this is done the results are beyond control. No one can tell for a certainty whether a pack of skins will come out right or not, and many skins are seriously damaged during the process. The liquor often putrefies and when this happens the leather is made flat and lifeless, owing to the fact that the interlocking fibres have been attacked and the depletion or bringing down carried too far. Sometimes in a very few moments after the stock is reduced to the right condition putrefaction sets in. It first shows upon the flesh side, which commences to peel off by gentle pressure of the finger. The skins change color, turning first blue and then gradually darkening. The grain becomes afflicted with minute holes known as bate pricks. These are readily seen and although they are very small they destroy the value of the leather for grain-finishing purposes.

By carefully watching and giving close attention to the work the faults are less liable to occur, and the skins safely prepared for tanning. It is upon the swollen skin substance that the bate works. It liquefies a portion of the skin substance, and this together with the lime washes out in the form of a colorless liquid and the skins become soft and silky. The slimy liquid is readily removed after purging by slight mechanical work or by a washing in warm water.

Goatskins are of close, hard grain

And will stand and in fact require a much more thorough cleansing than any other skins. It is customary, after the skins have been pured in the manure bate, to give them a further treatment, by which they are still further cleansed and any tendency to decay arrested. The skins are taken from the bate and given a thorough working upon the grain, by means of which the slime is forced out of the pores. When this has been done the skins are placed in a weak lactic acid bath made up in proportion of one-half gallon of

lactic acid in one hundred gallons of warm water. After a drenching in this liquor for thirty minutes the skins are removed therefrom, washed off in clean water and are then ready for tanning. The cleaner the skins are the more readily will they tan and the better will be the results of coloring and finishing. A point to be observed during this part of the work is that the temperature of the liquor should not be higher than ninety degrees. The use of warmer liquors than this burns the sensitive skins, shrinking them and causing the grain to be harsh and coarse.

THE BRAN DRENCH AS APPLIED TO GOATSKINS.

A method of drenching goatskins that has been in common use for many years is the bran drench. Many tanners consider this method and manure drenching the only methods of cleansing skins.

In the manipulation of the bran drench the operator must use judgment, as no hard nor fast rule can be followed. The efficacy of this process also depends upon the fermentive action developed, and for this reason it is necessary that the bran be fully fermented. In some tanneries where old sour tan liquors are to be had, a pailful of bran is used for each one hundred skins in enough sour liquor to enable the skins to process nicely. The drench is used at a temperature of ninety degrees, and the skins left therein over night. In the morning a new drench is prepared. One and one-half buckets of bran are used for each one hundred skins in sufficient warm water, and the skins are left in this drench until they have become thoroughly soft and clean. Another method is to use two hundred pounds of bran for every six hundred skins. The bran is mixed with sufficient warm water to make a thick mush, covered up and allowed to ferment. About one-half of the bran is put into the water in the vat and well stirred. Then about one-half of the skins are put in. Before putting them into the drench it is good practice to let them lie for an hour or

two in warm water. After the skins are put in the drench, the liquor should be thoroughly stirred, then the balance of the bran is put in and the remaining skins.

It usually requires, including the time consumed in developing the drench, from twelve to twenty-four hours to get the skins thoroughly worked down. In summer less time is required than in winter. After the skins are drenched to the proper condition they are removed from the liquor and well washed in warm water for a few minutes, after which they are ready for the tanning process.

CHAPTER VII.

THE CHROME TANNING OF GOATSKINS.

NEARLY all goatskins are tanned at the present time in chrome processes, both one-bath and two-bath processes being used. Several methods will be described. The original and most commonly used two-bath process consists of two acid baths, the first consisting of chromic acid, formed by the combination of bichromate of potash and muriatic acid, and the second consisting of sulphurous acid evolved from the union of hyposulphite of soda and muriatic acid. A practical method of carrying out this process is as follows: After the skins are reduced and cleansed in the bating liquor, they are washed for a few minutes in a weak lactic acid bath and then for another few minutes in warm borax water, prepared by adding five pounds of borax dissolved in hot water, to one thousand gallons of water. This washing is not always necessary, and is only needed when the skins have been very dirty. In many instances it may be dispensed with. The skins are next drained well, and then weighed.

A preliminary pickling in a solution of salt water and hydrochloric acid is an advantage, as it serves to plump up the skins and to keep them open during the process of tanning, and in such condition that they can be readily struck out after tanning. The pickle consists of ten pounds of salt for each one hundred pounds of drained skins dissolved in fifteen gallons of warm water. This solution is placed in the drum with the skins and the drum run for about fifteen minutes. Then the acid is added. For every one hundred pounds of skins in the drum, two pounds of muriatic or

hydrochloric acid are mixed with about one pail full of boiling water. The acid solution is then cooled by the addition of two pails of cold water. This diluted acid bath is poured into the drum and the skins milled in the salt and acid for another fifteen minutes. Upon coming from the acid treatment the skins are ready for the chrome process.

The first bath of this process consists of bichromate of potash, added to the acid pickled skins. For each one hundred pounds of skins two pounds of bichromate of potash are dissolved in hot water, which is then reduced with cold water until the temperature is about seventy degrees. For every one hundred pounds of skins about fifteen gallons of water should be used. The solution of bichromate of potash is added to the skins in the drum and drummed for at least thirty minutes, when the strength of the liquor is increased by the addition of four pounds of bichromate of potash for every one hundred pounds of skins, and two and one-half pounds of salt. This is given to the skins while the drum is in motion and the skins drummed therein until the thickest part of the heaviest skin shows thorough penetration of the yellow liquor. When this has been accomplished the skins are taken out of the liquor and allowed to drain for some hours or over night, being covered with damp sacks to keep out the light. In the morning they are struck out upon the machine or are pressed and the surplus liquor removed from them.

Another method of giving the skins the chrome liquor

Is to prepare a solution of bichromate of potash, water and muriatic acid, in the proportions of six pounds of the potash and three pounds of the acid in fifteen or twenty gallons of water. A few pounds of salt are also added. The skins are drummed in this liquor until they are thoroughly penetrated with it, then they are treated as mentioned above. The important point to be observed is that the skins are not done until the thickest skin is thoroughly penetrated with

the yellow liquor. When this is neglected the raw material left through the center of the skin causes the leather to dry out hard and stiff.

The second bath of the process, in which the chromic acid of the first bath is reduced to chromic oxide, is composed of hyposulphite of soda, water and muriatic acid. Before the skins are entered into the main reducing bath they should be dipped into a weak solution of hyposulphite of soda and acid, by means of which a slight surface reduction is accomplished. For every one hundred pounds of skins about four pounds of hyposulphite of soda are dissolved and added to fifteen gallons of water. The skins are dipped singly in this solution and then thrown over a horse for a short time to drain. The main reducing bath is carried out in paddle vats. For every one hundred pounds of skins weighed before the first bath, ten pounds of hyposulphite of soda are dissolved by boiling in about twenty gallons of water. This solution is added to the necessary quantity of water in the vat and the liquor is well stirred. Then five per cent. of the weight of the skins of hydrochloric acid is added to the liquor. The addition of the acid changes the color of the liquor to a white or milky color. The skins should be thrown in at once, and paddled about in the liquor until no trace of the yellow liquor is left. A good rule to follow is to enter the skins in the liquor in the morning and leave them in during the day, then to let them lie quiet during the night and be again stirred about for another hour in the morning. This completes the tanning. The skins gradually assume a pale bluish-white color and slowly lose the raw-hide feeling and become leather.

A new process of two-bath chrome tanning,

Upon which a patent has been granted, is carried out as follows: For each one hundred pounds of skins drained after the final washing, four pounds of bichromate of potash

and three pounds of muriatic acid of a strength of 20° Bé., mingled with the requisite quantity of water, constitute the first bath. In this the skins are drummed until the yellow liquor has entirely penetrated them, then they are removed from the drum and drained for some hours, struck out or pressed, and are then ready for the second bath. Into one hundred gallons of warm water are poured five pounds and five ounces of sulphuric acid 66° Bé. This is well mixed through the water and then are added by being slowly sifted in, four pounds of peroxide of sodium. While this is being done the liquor should be constantly stirred. When the powder has been added the previously chromed skins are entered into the bath and paddled until they are tanned.

Another Method.

There are several methods of tanning goatskins with the one-bath chrome liquors in practical use. A common process consists of first tawing the skins in a solution of sulphate of alumina and salt, and then giving them the chrome liquor. This may be done in various ways. A process in common use is carried out as follows: The skins are taken after the washing in warm borax water, drained and weighed. For every one hundred pounds in the pack, three pounds of sulphate of alumina, four pounds of glauber salt and five pounds of common salt are dissolved in six gallons of water. The glauber salt may be omitted and the quantity of common salt increased to eight or nine pounds. This solution is put into a drum with the skins, and the latter milled in the liquor for three-quarters of an hour, or until the tawing materials have been taken up by the skins and the grain has become smooth and free from stringiness. At the end of this time the skins may be removed from the drum, thrown over horses and allowed to drain for a few days, the longer the better, or they may be tanned with the chrome liquor without being removed from the drum. The

usual quantity of chrome liquor required by one hundred pounds of skins is three gallons. This is diluted with three gallons soft water, and the six gallons of liquor divided into three portions. The first portion is given to the skins at the end of three-quarters of an hour, and the skins drummed therein for thirty minutes; then the second portion is added and the skins drummed for another thirty minutes, then the last portion is given to the skins and the whole drummed for from one to two hours, or until the skins are thoroughly tanned. The skins are allowed to lie in the liquor over night and are then drained for twenty-four hours, after which they are washed for thirty minutes in warm borax water and for twenty minutes in clear, cold water.

Goatskins may also be tanned

Directly after the drenching and washing with the one-bath chrome liquor without the use of the sulphate of alumina and salt. The advantages of the last two articles are that the skins are plumped and filled somewhat, the fibres are kept from being drawn and the skins are kept in such condition that they can be struck out after tanning without springing back, which is sometimes a great annoyance in currying chrome leather.

When the sulphate of alumina and salt are not used, the washed and drained skins are drummed in a salt solution, ten pounds of salt in five gallons of water for every one hundred pounds, for twenty minutes. Then the chrome liquor is added in portions of one or two gallons at a time until three gallons have been used for every one hundred pounds, and the skins drummed in this until they are tanned through. This usually requires three hours, although the skins should be left in the liquor for twenty-four hours so as to give the salts taken up by them time to act upon the fibres. A washing in warm borax water for fifteen minutes and in clear water for thirty minutes completes the tanning.

Good leather is also made by tawing

The skins in the solution of sulphate of alumina and salt, and then drying them out. The longer the skins lie in the dry or crust state the better will be the resulting leather. When they are to be tanned with the chrome liquor they are placed in a drum with warm water and washed therein until every spot is uniformly moistened. Then the chrome liquor is given to them. The calf-kid tannage of salt, alum, flour and oil may be applied previous to the chrome process, and when this is done very little fat-liquor is needed to impart to the leather the requisite degree of softness. Soft water should be used with one-bath chrome liquors, as hard water contains lime, which sometimes produces undesirable effects.

Another good method

Of tanning the skins is by giving them the sulphate of alumina and salt in the drum, then removing the skins from the drum to tan them in the chrome liquors in vats. In carrying out this process the skins are treated in much the same manner as when they are being tanned in bark or sumac liquors. The tannage is begun in a weak liquor, and after they begin to absorb the tanning material, the liquor is strengthened until it is fairly strong. For every one hundred pounds of skins three gallons of tanning liquor are used. One gallon is added to the water at the beginning and the balance after the skins have begun to tan. Or for each one hundred gallons of water two gallons of the concentrated tanning liquor are added, thus making a two per cent. liquor. This is a good strength to begin with. As the skins tan the bath should be strengthened by the addition of more tanning material until it becomes a four or six per cent. solution. Some salt is also required. It keeps the skins open and plump, and receptive to the tanning liquor, thus hastening the process. Enough water should always be used to enable the skins to float and turn

in the liquor by the action of the paddles. The skins gradually assume a greenish-blue color, and when this color has penetrated the thickest skin the tanning is done. The process usually takes from one to two days, according to the strength of the liquor and the thickness of the skins. No harm can come to the skins by remaining longer in the liquor than is necessary. It is important that every skin be thoroughly tanned, as a thin sheet of raw substance through the center causes them to be hard and tinny when dried out.

The vat method of tanning is cheaper than the drum method, as much strength is left in the liquor after a pack of skins is tanned and this can be exhausted by a fresh pack. The suggestions that have been given in regard to the washing after drum tanning apply also to skins that have been tanned in vats.

A method of tanning goatskins with the one-bath process,

That results in the production of plump leather, is carried out as follows: After the bating and washing the skins are pickled in a solution of sulphuric acid, salt and water. This liquor may be made of two and one-half quarts of sulphuric acid, and fifty pounds of salt in a sufficient volume of water to enable the skins to be stirred about. While the skins are in this liquor they should be constantly stirred about; and taken out at the end of six hours. This pickling liquor thoroughly cleanses the skins and bleaches them. After they are taken out of the liquor they should be allowed to drain for a short time, and after draining they are weighed. The first part of the process consists of applying to the pickled skins a solution of sulphate of alumina and sal soda. For every one hundred pounds of skins to be tanned three pounds sulphate of alumina are dissolved in five gallons of water, by boiling for a few minutes, also three pounds of sal soda in five gallons of water. The solution of sal soda is slowly poured into the

alumina solution, a portion at a time, and short intervals allowed for the foaming to subside. The combination of the two solutions forms a milky-white liquor. If this is to be used at once, enough cold water should be added to reduce its temperature to 85 degrees. The pickled skins, after draining, are placed in the drum with ten pounds of salt and five gallons of water for every one hundred pounds of skins. The skins are drummed in this solution for five minutes until the salt has penetrated them. Then the solution of sulphate of alumina and sal soda is poured into the drum, and the skins drummed for thirty minutes. For each hundred-weight of skins in the drum one gallon of tanning liquor is next given to the skins, and the whole drummed for one-half hour, then another gallon for every hundred weight of skins is poured into the drum, and the skins drummed for one hour, then another gallon of tanning material for each hundred weight of skins is added and the skins drummed for from one to two hours, according to their thickness, until they are well struck through with the tanning liquor. To complete the process one-half pound of salts of tartar is dissolved in a little water and poured into the drum, and the drumming continued for one-half hour. At the end of this length of time, the tanning should be complete; but if any doubt exists in the mind of the tanner, the skins may be drummed for another hour, and then allowed to remain in the liquor over night. The tanned skins may now be removed from the drum and thrown over horses and allowed to drain for at least twenty-four hours, thus giving the tanning material taken up by them time to take thorough effect. This is followed by a washing in borax water, preferably warm (one pound of borax for each one hundred pounds of skins) for thirty minutes, and then in clean water for one hour or until the leather is perfectly neutral to the taste, after which it is ready for the work of striking out, shaving, coloring and finishing.

Another satisfactory method

Of tanning the pickled goatskins consists of drumming the skins for fifteen minutes in a solution of glauber salt consisting of one pound of the salt dissolved in eight gallons of water. At the end of this time the chrome liquor is applied to the skins, in quantities of one gallon at a time at intervals of one half-hour until three gallons have been used for every hundred weight of skins. The drumming in the chrome liquor usually requires about two and a half hours. By the end of this time the skins are usually well struck with the chrome liquor. In a small quantity of water one-half pound of bicarbonate of soda for each one hundred pounds of skins is dissolved and poured into the drum and the skins milled for another thirty minutes. Enough water should now be added to the contents of the drum to cover the skins, and the skins left in the liquor over night. After draining for twenty-four hours the tanned skins are washed for thirty minutes in warm water. Prolonged washing is not necessary in this instance, as is the case when sulphate of alumina is used in tanning.

The one-bath methods of tanning that have been described are very simple and safe. Unless serious mistakes are made, which is not likely, good saleable leather results from their use. The simplicity of the one-bath process is its greatest recommendation. Tanolin is the chrome liquor referred to in the above directions.

A New Process of Acid Tanning.

One of the most essential qualities of goatskin leather is a smooth, fine grain. A new process of acid tanning that produces this desired result has recently been introduced. It is applied practically in the following manner: While it partakes to some extent of the nature of the original two-bath process, it is really a one-bath process. Four pounds of bichromate of potash are used for each hundred pounds of skins. This quantity of potash is mixed with three pounds of muriatic acid of a strength of twenty degrees Bé.

The skins are treated to this solution in a vat for a period of time long enough to enable the yellow liquor to penetrate the thickest skin. Without removing the skins from this chrome liquor two solutions—called the S. Z. solution and the S. K. solution—are added, in the proportion of twenty per cent. of the former and thirty-five per cent. of the latter. These two solutions should be well mixed together before being given to the skins. After the two solutions have been mixed and added to the chrome liquor, five per cent. of the weight of the skins of sulphuric acid is mixed with about thirty times its weight of water and added to the bath. To prevent the acid from coming in direct contact with the skins, it should be added to the bath through a lead-lined funnel long enough to reach the bottom of the vat. While these liquors are being added the skins should be kept in constant motion. At the end of one and one-half days the tanning is done, although the skins may be left for a longer time in the liquor without injury. No contraction of the fibres results when this process is used, and no sulphur is present as in the older chrome process.

The S. Z. solution consists of eighty pounds of nitrite of soda dissolved in eighty-four pounds of hot water. The S. K. solution is composed of forty-eight pounds of fresh chloride of lime, forty-eight pounds of soda-ash and three hundred and eighty-four pounds of hot water. The soda ash is first dissolved in the hot water, and when it is all dissolved the chloride of lime is added through a sieve. While this is being done the liquor should be constantly stirred. When all the lime has been stirred in, the liquor is allowed to rest for two days, until all the sediment has settled to the bottom of the vessel. The clear liquor is drawn off and used in the process, while the sediment is thrown away. Both liquors S. Z. and S. K. may be kept in one vessel, carboy, vat or hogshead, provided the proper proportions are kept up, and when it is wanted the required

quantity is taken out and used. A wooden tank, tub or hogshead should be used for making the solutions. Goat-skins intended for glazed kid or patent or enameled stock are tanned in this process without pickling, being taken direct from the drenches and treated to the chrome liquor of the first part of the process.

CHROME TANNING ALUM-TANNED GOATSKINS.

Very fine kid leather is made by subjecting goatskins to a process combining alum and chrome tanning. Leather made by this process is full and plump, soft, and of fine grain and texture. For one hundred pounds of skins thoroughly bated and washed, and weighed after draining, an alum process is prepared consisting of nine pounds of alum, three pounds of salt and thirty pounds of wheat flour, thoroughly mixed together in fifteen gallons of water at a temperature of ninety degrees. To this liquor are added twelve pounds of egg yolk, which must be thoroughly incorporated with the other ingredients by vigorous stirring. In place of egg yolk alone being used, a mixture of egg yolk and oil may be used, about two-thirds egg yolk and one-third olive oil combined together. The skins and the solution are placed in a drum, which is set in motion and the skins drummed in the liquor for an hour, or until they have absorbed the contents of the drum. This completes the first step in the process, and is commonly called tawing. The tawed skins are next hung up and dried out; and after drying they should be allowed to lie in the dry condition before being finished.

The chrome part of the process consists in submitting the skins to a one-bath chrome liquor. When this is to be done the dry skins are uniformly moistened with warm soft water, and are then tanned in a drum in a chrome liquor. It usually requires three gallons of liquor and three hours drumming to complete the process, after which the skins are washed and finished the same as any other chrome

leather, with the exception that no fat-liquoring is required. The skins can also be tanned by this process by omitting the egg yolk and oil from the alum process and using only alum, salt and flour; and then after the skins have been chrome tanned to fat-liquor them with a fat-liquor of soap and oil, or of egg yolk and oil, then drying the leather out and finishing it in the usual way.

SUGGESTIONS AND PRECAUTIONS.

A very good rule to follow in the making of light leather by any chrome process of tanning is to sort the skins at the beginning of the work in the beam-house into three grades, according to weight or thickness: light, medium and heavy. When each class is treated by itself, the advantages gained by sorting are noticed in the much more uniform quality of the leather that results when a mixed lot of skins is treated without sorting. Some skins are open and porous, while others are close and tight-grained, and if both kinds are worked through together, the finished leather is liable to be very uneven in quality and texture. The open porous skins absorb more lime than others and absorb it in less time, while the close, hard skins will stand, and generally require, more thorough drenching and washing than the open porous skins.

The advantage gained by sorting the skins is especially apparent when a one-bath process of tanning is used. When the skins are nearly all of the same thickness, after being in the liquor a certain length of time they will be uniformly tanned, whereas if some of the skins are thick and heavy and others are thin and light, the thin ones will be tanned through in a much shorter time than the heavy ones. A saving of time, labor and tanning materials is accomplished by judicious sorting of the skins before they are tanned. A liberal quantity of salt should be used in the tanning liquor. It not only keeps the skins open and plump and receptive to the tanning liquor, thus hastening

the process somewhat, but also helps in making a light, soft leather. When chrome-tanned skins finish up hard and tinny, it may be taken for granted that either the stock was not limed enough before tanning, not thoroughly leath-ered, or not sufficiently lubricated with fat-liquor. Thorough liming and drenching are necessary for a good tan-nage that will carry the grease well. It is also highly important that the skins be entirely tanned and no thin sheet of raw material be left through the center thus caus-ing the skins to be hard and papery.

Two-bath processes require great nicety of proportions in order to get satisfactory results, and it is much easier to go wrong and suffer failure than to get the process right and achieve success. When a two-bath process is used and the chromic acid of the first bath does not penetrate through every fibre and the reducing agent of the second bath does not completely reduce the chromic acid to chromic oxide, the leather, being not fully tanned, dries out hard and stiff. If a one-bath process is used and the tanning material does not penetrate every fibre, the skins do not get completely tanned and the same trouble occurs. There is no economy in saving a few cents' worth of tanning material and losing dollars because of faulty leather. One-bath liquors, when used in paddle vats, are handled in much the same manner as bark or sumac liquors; that is, the skins are started in a weak liquor and this is gradually strengthened until the tanning is finished. The object of using a weak liquor at the start is to prevent the astringent liquor drawing or puckering the grain. A two per cent. liquor is usually used at the start, that is, two gallons of concentrated tan-ning liquors used in one hundred gallons of water, and this is gradually strengthened by additions of chrome liquor until it becomes a four to six per cent. solution. Soft water is required by most one-bath processes, as hard water con-tains quantities of lime and magnesia salts.

When the skins are perfectly free from dirt and lime they

begin to absorb the tanning material at once and thus gradually assume a greenish-blue color and the bath loses its strength. In order that the skins may grow into plump and well-tanned leather, it is necessary that more tanning fluid be added at short intervals in order to feed the leather and keep the strength of the liquor at the proper point. Skins left too long in a weak liquor tan out thin and lifeless.

When the tanning is completed and the skins are taken out of the liquor, considerable tanning material is left in the bath. This should not be thrown away, but another lot of skins started in it, and the fresh skins will completely exhaust the strength of the bath. A new liquor can be prepared and the skins from the old liquor tanned out in the new by strengthening it from time to time. In this way great economy in the cost of tanning can be achieved.

When skins are tanned in drums the length of time required to tan them can be easily regulated when the skins are of uniform thickness. When a mixed lot of skins are tanned, by the time the heavy ones are tanned through, the thin ones will be tanned more than enough. Prolonged drumming is not beneficial to the skins; on the contrary, the less drumming and pounding the skins are subjected to the better will be the leather as regards fullness and plumpness. The tight nature of goatskins enables them to stand prolonged drumming without injury, while calfskins are easily damaged by being drummed too long.

FAT-LIQUORING.

One of the most important stages in the whole process of making chrome leather is the fat-liquoring, by means of which the leather is nourished and lubricated; thus increasing its strength and softness. When proper lubrication is lacking, the fibers, being harsh and dry, grate on each other, and the constant friction causes the leather soon to become worn out. Only the best materials should be used as fat-liquors. Good oils certainly cost more than poor

oils, yet the better quality of the leather resulting from the use of good materials will more than repay the extra cost. The tanned skins should be sorted before being fat-liquored. When a mixed lot of skins is fat-liquored together the light ones absorb more grease than they require, while the heavy ones do not get grease enough. An unpleasant odor and white grease spots often occur when low-grade animal oils are used in finishing leather. These oils are prone to decomposition and fermentation, and when these things occur the bad smell results, and the oil by spewing out upon the surface not only injures the finish, but also the appearance of the leather. Olive oil is the best of all oils to use. Its high cost, however, stands in the way of its general use.

Certain defects and their correction.

An open, porous grain is sometimes caused by liming the skins too long and by very low bating or drenching. This fault may be partly overcome if not entirely eradicated by the application of a weak solution of lactic acid before the leather is finished. This seems to tighten the grain somewhat as well as to dry up the surface grease, and this assists in getting a clear, bright finish. A grey bottom on black leather is sometimes the result of the dye not having been gotten down into the grain. By first staining the skins a blue or purple the final color of the leather is much improved, the blue or purple color serving as a foundation for the black. It is generally desirable to have the flesh colored through, and to accomplish this the dye must be used warm and thoroughly milled into the leather by means of a drum. Considerable difference is often noticed between different lines of skins as regards fullness and plumpness along the sides and in the flanks. Some skins are well filled and plump in these parts, while others are very loose and flabby, sometimes to such an extent as to impair the value of the leather and to cause annoyance and loss to the cutter. The

higher-priced skins are not often afflicted in this way, since in the grading of the skins the condition of the sides and flanks is one of the chief things taken into consideration in determining into what grade a skin should go. Some classes of skins are naturally more flanky than others. Among goatskins the Patna and Brazilian skins are the least flanky of any, while the cheaper skins, such as the Chinas and some European and African skins, are not only coarse-grained but coarse and loose along the sides and in the flanks. When this condition is natural in a skin it is impossible to be overcome, although it can be somewhat diminished by judicious handling by the tanner. When the sides and flanks are naturally full and plump before tanning, and then are loose and flabby after tanning, it is generally the result of improper methods of working the skins, especially in the beam-house. A faulty condition of the flanks is often caused by the skins having been limed too long. Prolonged liming causes the skins to become loose and open by reason of skin substance being dissolved by the lime. The flanks being naturally thin and open are the most liable to show up the damage done by over liming. Nothing that the tanner can do will overcome the injury done in this way. Chrome tannages do not fill the leather nor produce plumpness as other tannages do, and for these reasons the skins must be handled during the processes of the beam-house in such a manner as to guard against loss of substance and plumpness as much as possible. A short, quick liming in a clean mixture of either lime and sulphide of sodium or lime and red arsenic results in preparing the skins in a short time without the loss of substance which always causes the leather to be thin and soft. Some plumpness can be acquired by tawing the skins in a solution of alum and salt before chrome-tanning them, but this is not always practicable. The skins are also sometimes injured by the prolonged drumming to which they are subjected when drums are used. When they are tanned

in paddle-vats they are not pounded, and by being allowed to absorb the tanning material slowly they grow into fairly plump leather.

Goatskins are generally afflicted with coarse, rough grain along the necks and shoulders.

By skillful handling by the tanner this defect may be to some extent overcome. It must be done before the skins are tanned, during the process of bating or drenching. Some bates give a smoother and more elastic grain than others, but they are also liable, unless carefully manipulated, to reduce the skins to the condition of rags, and when skins so completely reduced are tanned, the leather is very loose and lifeless. Manures produce good results on goatskins provided the skins are not reduced too much, and after the manure bating the skins should be given a washing off in a warm lactic acid bath for a few minutes. A coarse, rough grain is also sometimes caused by fresh white lime used towards the end of the liming process. A manure bate is the best to use to accomplish the reduction of the rough grain and give the grain the smoothness and softness so much desired, but it must be carefully handled. Some materials used as bates remove or neutralize the lime without reducing the skin; that is, they do not attack the substance of the skins, but leave them full and plump, and skins so prepared always work out with considerable plumpness and life. The cheaper grades of goatskins are all rough and coarse in grain and fibre. Unless such skins are very carefully handled, they will not result in very desirable leather, as the faulty grain and texture prevent their being used for any except second-class purposes. The coarseness can be somewhat lessened by careful beam-house work, but of course never completely eliminated. Much depends, too, upon how the skins are tanned and the articles used in tanning and coloring them. The quality of leather is produced more by the methods of working the skins during

the early process of the beam-house than by the actual process of tanning. Skins that have been mistreated in the beam-house will never make good leather, no matter what tannage is used. Unless the materials used in tanning the skins are thoroughly removed from them, they will ferment in the leather, and not only make it greasy, but will cause white spots to appear upon the grain, resembling mildew. The alkaline fat-liquors tend to counteract acidity in the skins to some extent, but they never entirely remove it until the cause is removed.

Some tanners of goatskins after washing them thoroughly in borax water place them for a few hours in a hot bath of sumac. This serves to bleach the skins, to fill them somewhat, and to soften them, giving them a soft, smooth feel. The treatment of chrome leather with any substance containing tannin tends to open the grain somewhat, and when the tannin solution is too strong, to roughen the grain.

While salt serves a very useful purpose in chrome tanning, its use in excessive quantities makes the leather too soft and open. Instead of using large quantities of salt, it is better to use not more than six pounds of salt for each hundred pounds of skins, and to start the skins in a weak chrome liquor and to gradually strengthen it. This procedure prevents the drawing of the grain and avoids making the leather soft and open.

CHAPTER VIII.

THE FINISHING OF CHROME-TANNED GOATSKINS INTO COLORED AND BLACK, GLAZED AND DULL LEATHER.

THE finishing of goatskins that have been tanned by a chrome process into colored or black leather involves a number of processes, the objects of which are to give to the skins the desired color, degree of softness and pliability, uniformity of thickness, and, in the case of glazed leather, the smooth and bright face surface.

After the washing of the skins is completed, the skins should be well struck out by hand or on machine, or they may be pressed or wrung, in order to remove from them as much of the surplus water as possible.

When struck out or pressed the skins should be shaved, and during the shaving kept from all stain and grease, because at this stage of the process the skins absorb stain and grease readily, and these interfere with the coloring and finishing. By the shaving the skins are made of uniform thickness, and the flesh side is made clean and smooth, a necessary condition when the leather is to receive a glazed finish.

Black.

When the grain side of the leather is to be dyed black, it is customary to first color the skins blue or purple upon the flesh side. To accomplish this various methods may be used. The following method is a very practical one, and produces a very satisfactory result. The skins are drummed in a sumac liquor, consisting of three or four ounces of liquid extract of sumac in five gallons of warm water for each dozen skins. The sumac serves as a mordant. Then the

skins are dyed with a purple aniline, about three ounces of the same being required by each dozen skins. After the purple aniline has been applied, the skins are passed through logwood, hemolin or hæmatine liquor and then blacked with a striker, and finally dyed with a fast black aniline at a temperature of 130 degrees. The black aniline may be omitted and the grain blacking done with logwood and striker. This procedure leaves the skins blue upon the flesh and black upon the grain.

The grain blacking may be done by passing the skins through a coloring machine, or by folding them through the centre, grain side out, and working them through the dye in trays or dye-boxes. Palmetto extract may be used in place of the sumac and in the same manner. It prepares the skins to receive any dye material, and makes the grain smooth and solid and less liable to peel. The flesh side of the skins can also be dyed blue or purple by the use of solutions of logwood and borax; blue nigrosine and blue anilines are also used. Logwood in the extract or powdered form produces good results. The results obtained from the use of the powdered logwood are better than those obtained from the use of chips, since the powders are always uniform in quality and strength. When paste extract is once frozen the color produced is not at all satisfactory, being a muddy gray black. The powder as it cannot be frozen always produces good results. About six pounds of logwood powder dissolved in warm water with one pound of borax or sal soda, and brought to the boiling point, give a liquor of sufficient strength. If this proves too strong it is an easy matter to reduce the quantity of dye used. This solution may be used for coloring the flesh blue. A good color can also be obtained by adding to it a small quantity of methyl violet aniline. In about thirty gallons of logwood, three ounces of the aniline, and two ounces of nigrosine may be used. The skins should be drummed in this liquor until the color is well taken up and developed and then placed

on a table and a striker of iron liquor applied to the grain. This gives a blue flesh and black grain. Ten gallons of liquor prepared as above are enough for one hundred pounds of leather. The skins may also be passed through the striker in dye boxes or run through a machine.

The method of getting a blue flesh with nigrosine

Is as follows : For each dozen skins, medium size, from two to three ounces of blue nigrosine are boiled for a few minutes in two gallons of water. This is added to the skins in the drum at a temperature of one hundred and twenty degrees and the skins drummed in the color for thirty minutes, or until the color has been well taken up. Unless the leather is thoroughly washed after tanning, the blue color will not penetrate as it ought to. The water is next drained off, the leather pressed or struck out and is then ready for the fat-liquor. When logwood is used a black on the grain is obtained by the use of an iron liquor or a liquor made of copperas. A good liquor or striker for the purpose is made of four and one-half pounds of copperas, one and one-half pounds of blue vitriol dissolved by boiling in forty gallons of water. A stronger liquor is generally used in machine dyeing—twelve pounds of copperas and four pounds of blue vitriol to forty gallons of water. To the first formula add one and one-half pounds of ground nutgalls and one pound of epsom salts to each six pounds of copperas and blue vitriol combined. When the skins are dyed upon tables a small quantity of ammonia should be added to each pailful of logwood dye. This is applied to the skin and well rubbed in, then the striker is applied, the skin struck out again, more dye applied and more striker. The skins are next washed off in warm water and again struck out.

The fat-liquoring and grain-blackening may be accomplished in one operation. The black is composed of warm logwood liquor in which are dissolved five pounds gum

arabic. In another vessel are dissolved eight pounds of copperas. Into twenty-five gallons of strong logwood liquor are mixed the gum and copperas solution. After the fat-liquoring has been accomplished this black liquor is added to the skins in the drum, and the skins drummed therein for five minutes, after which they are washed in cold water, and struck out either by hand or on the machine.

The leather can also be blacked by dyeing on a machine, by brushing as has been suggested, or it may be folded and dyed in dye boxes as follows: The skins are folded through the center and smoothed out with a glass slicker, so that no blacking will reach the blue flesh and mar its appearance. The skins are passed first through warm logwood liquor and then through the striker in dilute form, washed off and finished in the usual way. A few fustic chips boiled with logwood liquor intensify the black.

THE USE OF PERMANGANATE OF POTASH IN COLORING LEATHER.

One important advantage gained from the use of permanganate of potash is that about one-half the quantity of logwood liquor usually employed will be found sufficient. This effects a considerable saving.

The beneficial effects of permanganate of potash to chrome-tanned goatskins intended for glazed kid must be apparent to those who have given it a careful trial. The question is how to apply it to the leather with the least trouble and labor to produce the best results. Either of two methods may be followed.

1st. In a reel containing 650 gallons of water add five pounds of permanganate of potash, which has been previously dissolved in a little hot water. The temperature of the bath should be about one hundred and ten degrees Fah. The skins upon coming from the tanning liquors are thoroughly washed and are then entered into the above bath. After remaining in the bath with the paddles revolving for

about thirty minutes, the stock is removed, horsed up for twenty or thirty minutes, and the usual operations of staining, fat-liquoring and coloring may now be proceeded with in the ordinary manner. This treatment with permanganate of potash kills all traces of sulphurous acid in the skins, therefore it is not necessary to use alkalies such as soda or borax in the water in which skins are washed from the reducing bath, as is generally the practice. Or the permanganate may be applied to the stock in this manner.

2nd. After tanning, wash the skins, stain and fat-liquor them in the usual manner. The skins are then smoothed out with a slicker, and, after being folded, grain side out, each skin is dipped into a bath consisting of a solution of permanganate of potash, which is prepared in the following manner: Five pounds of permanganate of potash are dissolved in thirty gallons of water to form a stock solution. Of this stock solution one gallon is mixed with twelve gallons of water, which forms a bath capable of treating one hundred pounds of skins. In preparing the bath in the first instance the percentage of permanganate solution may be increased to about two gallons; but after treating the first batch of skins, an addition of one gallon of the solution for each subsequent batch of one hundred pounds of skins will be sufficient to maintain the bath at the proper strength. After allowing the stock to be drained well, the final coloring may then be proceeded with in the ordinary manner, except that one-half the usual quantity of logwood liquor will be sufficient. If the permanganate does not appear to strike evenly and the stock shows any indications of spots, streaks or teeth, a little salts of tartar should be added to the bath, or the stock solution may be prepared by dissolving five pounds of permanganate and two and one-half pounds of salts of tartar in thirty gallons of water. The workmen who dip the stock in the permanganate liquor should wear rubber gloves.

The advantages resulting from this process are that a fine

base or foundation for the color is formed ; the grain of the leather appears smoothed down ; all roughness, stringiness, beardiness lessened, and presenting when glazed a smooth, fine, unctuous feel, a brilliant, lustrous color and a high clear finish.

The methods employed in coloring the skins, after they have been treated with permanganate of potash, vary, depending upon the color or the shade that is desired. Skins treated with permanganate of potash may be colored any shade of color. For tan shades, the preliminary treatment of the skins may be with a solution of tanning material such as sumac or gambier, and after this has been applied to the skins, the permanganate of potash is applied, and this is followed by an application of aniline dye of the desired shade. By subjecting skins to this treatment, more permanent and uniform results are obtained. The process is applicable to skins tanned by the use of alum, bark or other materials as well as to chrome-tanned skins. It has been used in practice, however, mostly upon goatskins intended for glazed kid.

This process is patented by W. N. Morris, Princeton, N. J.

COLORING CHROME-TANNED GOATSKINS WITH ANILINE DYES.

Chrome-tanned goatskins are readily colored any shade with aniline dyes, provided they are first properly prepared to receive the dye, and the right materials and methods are used in the coloring operations. There are numerous methods used by practical leather dyers in their work. These methods, of course, vary according to the experience of the operator, each dyer having learned by personal experience the best method adapted to his particular needs. The most common method of preparing this class of leather for the reception of aniline dyes, is by the use of tanning extracts, such as sumac, hemlock, palmetto and gambier, applied as mordants.

Before any attempt is made at coloring the skins, how-

ever, it is very essential that they be thoroughly washed in order to rid them of all acids and salts acquired during the process of tanning. This washing needs to be very thorough; and before the skins are colored they are generally shaved and made of uniform thickness and smooth and clean upon the flesh. During the processes of washing, pressing or striking out, and shaving the skins should be kept from contact with stain and grease, which are readily absorbed by them at this stage of the work and interfere with the subsequent coloring and finishing.

The tanning materials used as mordants frequently contain gummy matter which causes spots to appear upon the leather. To avoid this, the solution should be carefully strained before it is used. Perhaps the most commonly used tanning material in coloring chrome-tanned goatskins is sumac. This article by reason of the small amount of coloring matter that it contains is naturally adapted to the production of light and fancy shades. It is used in various ways. Upon small and medium size skins, about four ounces of liquid extract of sumac may be used, for each dozen skins. The sumac is mixed with water at a temperature of 110 degrees Fah., and the skins may be drummed in the liquor so prepared for twenty minutes. Dry powdered sumac is also used. After the skins have been washed and shaved they are run in a pin mill drum in a bath of warm water at a temperature of 110 degrees, to which about two pounds of the sumac have been added. The particles of sumac serve the very useful purpose of taking up any free grease upon the grain of the skins, as well as acting as a mordant by giving up tannic acid.

The skins may also be prepared for coloring in the following manner:

Two hundred pounds of well-washed and shaved leather are placed in a drum containing about sixty gallons of water at a temperature of 95 degrees F., and a solution

of sumac extract prepared of six to eight pounds of extract and four to six gallons of hot water. After the drum has been set in motion, about one-third of the above solution is added, and the remainder when all the tannin has been extracted. After thirty or forty minutes' drumming, the skins will have absorbed all the tannin, and the exhausted liquor may then be run off. After this the skins are washed for about fifteen minutes with cold or lukewarm water, then struck out or pressed without being allowed to dry out.

Chrome-tanned skins must in every instance be colored before they become dry,

As no method has yet been discovered by which the dried skins can be colored. Instead of sumac extract, a fresh infusion of sumac leaves may be employed; and when dark shades are to be dyed, the sumac may partly, up to two-thirds, be replaced advantageously by cube gambier or terra japonica. The skins may also be treated with sumac in tubs or vats, by being left for some hours in a warm bath of the same. The quantity of sumac used may be the same as above suggested, the material being mingled with warm water in a tub or vat, instead of a drum. From the sumac bath the skins are washed off. This procedure gives the skins a very light color, in fact, when skins are treated in this way and are dried and finished without coloring, they make nearly white leather. The sumac tends to soften the skins, besides serving as a mordant. After skins have been treated with sumac, they should be given a solution of either tartar emetic or antimonine, by which all uncombined tannin is overcome, the grain of the skin is cleared, and the aniline dye is fastened evenly and firmly upon the leather.

Fustic.

A material very frequently used as a mordant or base for aniline dyes upon chrome-tanned goat-skins is fustic.

This is used in extract form in much the same manner as sumac is used. Five ounces of the liquid extract of fustic used for each dozen skins of medium size, produce good results. It may be used for either light or dark shades. For very dark shades, such as chocolate, dark tans, etc., it may be used in equal parts, with a pure logwood extract liquor. The skins may be drummed in the liquor at a temperature of 110 degrees F. for fifteen minutes, or they may be paddled or stirred about in the same for thirty minutes.

Gambier and hemlock extract are sometimes used in coloring chrome leather, but not so frequently as sumac or fustic.

Palmetto extract as a mordant.

Very good results are obtained from palmetto extract used as a mordant. This material is a good fastener of aniline dyes, and by its use the grain is made solid and less liable to peel than when some other extracts are used. The grain also remains smooth and does not roughen or get loose. About five ounces of the extract may be used for each dozen skins at a temperature of 110 degrees, and the skins drummed therein for twenty minutes. Or the material may be applied to the skins in a reel or vat. For one hundred pounds of skins weighed after shaving, slightly less than one pint of the extract is required, and may be applied to the skins either by drumming in a pin-mill for fifteen minutes or by paddling in a reel for thirty minutes. Palmetto extract also neutralizes any acid in the skins; and the leather treated with it takes even cooling and carries the fat-liquor well.

Clearing the grain of grease.

Goatskins that are greasy upon the grain may be cleared of such grease by being drummed or paddled in a solution of lactic acid, made up of one gallon of the acid mixed with fifty gallons of warm water, about 100 degrees F. In this solution the skins may be either drummed or paddled for

thirty minutes, then washed thoroughly with water before being treated with the mordant or coloring materials. The use of the acid solution not only removes surface grease but also serves to open up the grain a little, thus allowing the dyeing materials to go on evenly.

The following instructions are practical working directions for dyeing chrome-tanned goatskins

Many of the most desirable shades with aniline dyes. These instructions will in every instance produce satisfactory results when they are carefully and intelligently carried out. The skins, previous to the application of the aniline dye, may be mordanted with the tanning extracts and in the manner that has been described. This work is best done in drums. After drumming in the tannin for fifteen or twenty minutes, a solution of tartar emetic or of antimonine may be added. This may consist of about two ounces of either of these materials dissolved in hot water for each dozen skins, and added to the tannin bath. The drumming is then continued for another fifteen minutes, then the skins are washed off in clean warm water and are ready for the color bath. The objects of using tartar emetic or antimonine are that the uncombined tannin resting upon the grain of the skins is overcome, the grain is cleared and the aniline dye will be firmly fastened upon the leather. The two articles are very similar in effect, the antimonine being the cheaper article of the two. When they are used it is not necessary to use any other article, as for instance bichromate of potash to set the colors. Drum coloring is, in almost every instance, the preferred method. It is always done before the skins are fat-liquored.

As the skins are always colored before they are dried out and finished, and as the drying-out and finishing of the leather frequently change the shade, it is very important that the dyer knows just the quantity of dye to use in order that the skins will come out the required color. The

quantity of dye-stuff required for a given lot of skins depends, of course, upon the size of the skins, large skins requiring more dye than small ones. Before proceeding to carry on coloring operations on any extensive scale at all, it is good practice for the dyer to make a few experiments on a small scale, say, with one or two dozen skins, and in this way learn the exact quantity of material to use.

Particular care must be taken to have the anilines thoroughly dissolved before they are used. To insure even coloring, the color solution should be added to the skins, a portion at a time, through the hollow gudgeon of the drum, and after all the dye is in, the skins should be drummed for at least fifteen minutes.

Ox-blood shades.

A dark rich ox-blood shade is obtained on chrome-tanned goatskins by mordanting them with tannin extract at a temperature of 110 degrees, followed by tartar emetic or antimonine. The dye solution may consist of from three to six ounces of aniline amaranth, 3 R, according to the size of the skins, and from one-eighth to one-fourth of an ounce of malachite green. When tartar emetic or antimonine is not used to set the color, it is necessary to apply to the skins after they have been drummed in the color, one ounce of bichromate of potash, dissolved in hot water for each dozen skins in the drum.

Another ox-blood shade is obtained by applying to the prepared skins, in a solution at a temperature of 120 degrees, three ounces of amaranth 3 R for one dozen skins of average size. This produces a lighter shade of ox-blood than the foregoing, the green aniline in that formula being used for the purpose of darkening the shade.

A correct shade of ox-blood may be obtained on two dozen skins, measuring sixty feet to the dozen, by mordanting them with a solution of hypernic extract, prepared by boiling thoroughly ten pounds of hypernic chips, and

straining the solution, and adding the same in portions to the skins in the drum. In place of hypernic chips, solutions of fustic, sumac or palmetto extract may be used with good results. The skins should be drummed in the extract liquor for at least twenty minutes, and longer will do no harm. Then for the two dozen skins, seven ounces of amaranth 3 R are dissolved by boiling and strained and applied to the skins at a temperature of 120 degrees. After the dye is in, the skins may be drummed for twenty minutes, then three ounces of bichromate of potash may be dissolved in two gallons of hot water, and this solution added to the contents of the drum and the drumming continued for ten minutes longer.

By a combination of Bismarck brown and Russian red, another good ox-blood shade is produced. For one dozen skins of medium size, about three ounces of Russian red are dissolved, and to this solution is added one ounce of Bismarck brown. The color solution is applied to the skins in the usual way, after they have been mordanted with extract. Russian red, used alone, produces a very pretty shade of wine color. A combination solution of two and one-half ounces of amaranth 1 R in place of the amaranth 3 R, and one ounce of chocolate brown also produces a full, clear ox-blood shade.

BROWNS.

A desirable chocolate brown may be secured by the use of three ounces of Chocolate Brown 270, applied after the tannin bath. Leather brown F, also produces a desirable chocolate shade when saddened with a little green or blue. Another chocolate is obtained in the following manner: For one dozen skins, five ounces of liquid extract of fustic are used. In this the skins are drummed for fifteen minutes, then the tartar emetic or the antimonine is added, and the drumming continued for another fifteen minutes, after which the skins are washed off and colored with a solution

composed of the following dyes: Four ounces of phosphine for leather; one-fourth of an ounce of leather green, M; one-half ounce of methyl violet, 2 B. The dyes must be thoroughly dissolved and well mixed together before they are used. Various shades of brown result from solutions of phosphine for leather saddened with varying quantities of blue, green and purple aniline. Also by a combination of phosphine for leather and leather brown, in the proportions of one-third as much of the latter as the former.

TAN SHADES.

The number of tan shades that can be obtained with aniline dyes is almost unlimited. Tobacco Brown produces a good shade, as does also Bismarck Brown when combined with Phosphine and saddened with Neutral Blue. Bismarck Brown and a violet aniline also produce a yellow brown. New Phosphine G. when used alone and not in combination with other dyes, gives a very light, clear yellow tan shade. This dye material is of great value to the leather dyer. A great number of light and dark shades result from its use in conjunction with other dyes in varying proportions. It is exceedingly fast to light. Combined with Methylene Blue, Phosphine G produces a greenish tan shade, very pretty and well developed.

The solidity and firmness of the skins may be slightly increased

By washing the skins as they come from the tanning bath in a solution of whiting and salt, using about ten pounds of salt, and five pounds of whiting in fifty gallons of water, one-half of this quantity being sufficient for one-hundred pounds of leather. The skins may be drummed in this for one-half hour, then washed in clean water until the whiting has been entirely washed off, then the skins may be shaved and colored. By shaving the skins before they are colored a saving in the amount of dyestuff is effected. A solution of lactic acid and bichromate of potash

in warm water is sometimes made use of in mordanting the skins. It may consist of two pounds of the potash and one-half gallon of the acid in fifty gallons of water. The skins are drummed in this for twenty minutes, washed off and colored.

To a great extent the results obtained in the coloring process are influenced and determined by the methods employed in the processes through which the skins have been worked previous to coloring,

As well as by the nature and quality of the materials used in these processes and the care and skill exercised in using them. In other words, the relations between the processes of the beamhouse and tannery to the coloring process are very close, and unless the former processes are carried out properly, the results obtained in the coloring process will not be satisfactory. A great deal, too, naturally, depends upon the quality of the coloring material used. While many of the defects frequently met with on colored leather are caused by improper and careless methods of dyeing, they are also frequently the results of carelessness or ignorance in the earlier processes.

Goatskins, being usually hard and dry and salty when they are received at the tannery, need to be very thoroughly soaked and softened before they are depilated or limed.

Not only is this precaution necessary but they must be freed of all salt and dirt, as the removal of these materials has much to do with the production of bright and clear-grained leather. At the same time the skins should not be soaked too long, as this sometimes results in loose and lifeless leather. Foul soaks cannot be recommended for skins intended for fancy colors, as the grain is often injured in such soaks in such a way that later on no one can tell what caused it and the blame is laid upon some other portion of the work. A shaded and spotted grain often results when foul soaks are

used. Fresh clean water is the only safeguard against such defects. All salt in the skins should be gotten rid of as quickly as possible during soaking, because when it is left in the skins when they go into the limes it is liable to cause spotted and cloudy grain.

Chrome tannages do not fill the leather as vegetable tannages do,

And for this reason some care must be exercised in handling the skins during the processes of the beam-house in order to prevent loss of plumpness. Sulphide of sodium used with lime does not give so much softness to the skins as red arsenic, and therefore is not so good for goat leather. Red arsenic used in combination with the lime brings the skins into good condition for unhairing, and also dissolves the amount of substance required to make the leather elastic and soft before the strength of the fibres has been weakened. The grain is also made soft and smooth. The limes should be kept perfectly sweet and clean, and the skins during the work of liming and unhairing should not be exposed to the air any more than is absolutely necessary, nor be allowed to become dry and hard in spots and around the edges.

Cleansing of lime.

Another necessary element in the making of fancy colored leather is the thorough cleansing of the stock of all lime. Lime is the great enemy of the colorman, and leather containing it, even in very small quantity, never colors satisfactorily. The methods employed in ridding the skins of lime are always of much importance, and when the latter are to be colored fancy shades the methods take on additional significance. After the skins have been thoroughly cleansed of lime by the processes of bating and washing, they should be thoroughly slated or worked upon the grain, as the cleaner and purer the grain is before tanning, the brighter and clearer it will be after coloring and finishing. The skins must be thoroughly tanned and no raw substance

left through the center. Nothing but the best quality of dyeing materials should be used, as the best leather can be readily injured by poor dyes. Since among goatskins there are marked differences and peculiarities of grain and fibre it is good practice, in order that the leather may color uniformly, to sort the skins according to texture and quality before any attempt at coloring is made. In order to classify the skins to the best advantage the sorter must use judgment and experience, since the sorting is largely done by the feel and appearance of the skins; the quality of the grain, whether it is soft and smooth or rough and hard, determines to some extent into which class and color a skin should go. The skins that are loose and open in grain and fibre should be separated out from those that are close and firm and colored separately from them. The lightest-colored and clearest-grained skins should be colored the fancy light shades, and the spotted or dark-colored skins be worked into black or dark shades of color. Many small defects that might appear very plainly on light-colored leather and reduce its value, are scarcely discernible in dark shades or black.

The quality of the water used in the coloring process

Has much to do with results obtained. Very hard water sometimes causes a faded and dingy appearance of the colors, and when such water is used in dissolving aniline dyes it not infrequently happens that a portion of the dye settles to the bottom of the vessel in the form of a soft mass. This naturally causes imperfect coloring. It is also imperative that the water be clean and free from dirt and foreign substances. The undesirable effects of hard water may be prevented and such water better adapted for coloring purposes by being softened by the addition to it of a small quantity of borax, which being a gentle alkali assists somewhat in giving a soft feel to the leather. The amount of borax to be used depends upon the condition of the water. As a general

rule one-half pound is enough for one hundred gallons of water, dissolved in a separate vessel and poured into the water to be used in coloring. The best water that can be used is condensed steam, which can be easily collected for use by placing barrels under exhaust steam pipes. This water is very soft, pure and clean. When aniline dyes are being dissolved care should be taken to dissolve them thoroughly and to leave no sediment in the vessel. It is well to have the water heated to a temperature of 160 degrees, then to add the color and to allow it to go into solution, after which the liquor may be boiled for a few minutes. It is also good practice to strain the dye solution before applying it to the skin.

COLORING CHROME-TANNED GOATSKINS WITH SULFAMINE DYES.

Chrome-tanned goatskins are very satisfactorily colored with sulfamine dyes. These dyes, when they are properly used, produce full, clear and uniform shades of color. They are not used in the same manner that aniline dyes are used. No mordanting with tannic acid is required. It is merely necessary to thoroughly wash the skins after they are tanned, in order to rid them of all salts and acids and to get them in perfectly neutral condition before applying the dye. The skins should also be free from grease. The dyeing may be done in drums or reels, such as are in common use. In order that the color may penetrate readily, a small quantity of carbonate of ammonia may be added to the dye liquor, but this must be neutralized afterwards by a little acetic acid.

The following instructions are practical working directions for getting several very desirable shades with sulfamine dyes.

Browns and dark tans: A very desirable dark shade of tan is obtained by using for each dozen skins of medium size, $2\frac{1}{4}$ ozs. of Sulfon Brown B., $\frac{1}{8}$ oz. Sulfon Carmine B, $\frac{1}{2}$ oz. Urania Blue B. These dyes are dissolved in boiling

water, a small quantity of carbonate of ammonia is added, and the color solution is ready for use. The temperature of the dye liquor should be 130 degrees, and the skins may be drummed for fifteen minutes or paddled in a reel for thirty minutes.

A *shade of tan* somewhat similar to the above, differing only by being a shade lighter, is obtained on one dozen medium-size skins by the use of $\frac{1}{2}$ oz. Urania Blue, $1\frac{1}{2}$ ozs. Sulfamine Orange P, 2 ozs. Sulfon Brown B, used in the same manner as above suggested. A brownish-tan shade is obtained by the use of $1\frac{3}{4}$ ozs. Sulfon Brown B, $\frac{1}{2}$ oz. Urania Blue R. Used alone, the Sulfon Brown is a little too fiery. The Urania Blue serves to sadden, subdue and darken the shade.

A *dark chocolate* is obtained by the combination of the following dyes: 3 ozs. Sulfon Brown B, $\frac{1}{8}$ oz. Sulfon Carmine B, $\frac{1}{2}$ oz. Urania Blue. The penetration of the dye liquor is hastened by adding to it a small quantity of Carbonate of Ammonia.

A *chocolate shade* is also secured by the use of 2 ozs. Sulfon Brown B, $\frac{3}{4}$ oz. Urania Blue B, $\frac{1}{4}$ oz. Sulfon Carmine B. The quantities of dyes mentioned are usually required for each dozen skins of medium size. Very large goatskins, of course, require more dye.

The following formulas are useful in getting light shades of *tan*, such as are often wanted for shoe and slipper purposes. $2\frac{1}{2}$ ozs. Sulfon Brown G, $\frac{1}{4}$ oz. Urania Blue B. Slightly different is the following: $\frac{1}{4}$ oz. Urania Blue B, $\frac{3}{4}$ oz. Sulfamine Orange P, 1 oz. Sulfon Brown B. A yellow tan results from the use of $1\frac{1}{2}$ ozs. Sulfon Brown B, $\frac{1}{8}$ oz. Urania Blue R. This shade is slightly darker than the foregoing: $\frac{3}{4}$ oz. Sulfon Brown B, $\frac{3}{4}$ oz. Sulfamine Orange NO, $\frac{3}{4}$ oz. Hæmatine Powder. No Carbonate of Ammonia is required in this last formula.

For an *ox-blood shade*, deep, rich and well developed, $5\frac{1}{2}$ ozs. Sulfon Carmine B, $\frac{1}{4}$ oz. Sulfamine Yellow D, and $1\frac{1}{2}$

ozs. Hæmatine Powder may be used. A small quantity of Carbonate of Ammonia may be added to good advantage. Another ox-blood formula = $1\frac{3}{8}$ ozs. Sulfon Brown B, $4\frac{3}{4}$ ozs. Sulfon Carmine B, $1\frac{1}{4}$ ozs. Hæmatine Powder.

Various shades of green.

By the use of the following combination of dyes a very pretty bright green is obtained on one dozen skins: $3\frac{3}{4}$ ozs. Paranil Yellow, $1\frac{3}{4}$ ozs. Blue J E, $\frac{1}{2}$ oz. Green P. For a darker shade of green may be used, $1\frac{1}{2}$ ozs. Blue J E, $2\frac{1}{4}$ ozs. Paranil Yellow. Very light grass greens, 2 ozs. Yellow C Y, $\frac{3}{4}$ oz. Green P. Also for a slightly darker grass green, $1\frac{1}{4}$ ozs. Green G A, $\frac{1}{2}$ oz. Sulfamine Yellow D. A dark olive green results from the use of 1 oz. Sulfon Brown B, 1 oz. Blue J E, or, 1 oz. Sulfon Brown B, 1 oz. Green P.

Fat-liquoring.

The skins, after being colored, should be fat-liquored at once, the surplus water being, of course, struck or pressed out before fat-liquoring. The fat-liquor should be used at a temperature of 120 degrees F., and the skins drummed therein for at least thirty minutes. Care must be taken that the fat-liquor is neutral, that is, containing no excessive amount of alkali. Some dyes are readily injured by an excess of alkali in the fat-liquor. A very good neutral fat-liquor capable of imparting great softness and smoothness to chrome-tanned goatskins may be made by emulsifying egg-yolk and neatsfoot oil.

After the fat-liquoring is completed, the skins are struck out, given a light application of glycerine and water upon the grain, followed by a light coat of oil, and then dried out, staked, softened and finished.

The process of fat-liquoring.

In order that the skins after being colored may be finished into soft, and saleable leather, it is necessary that they be suitably treated with grease in order that they may

acquire the required qualities of softness and strength. This is accomplished by the process of fat-liquoring. To a great extent the character and quality of the finished leather depends upon how this part of the work is done. Nothing can be used that will even in a small degree affect the color, or cause the skins to be streaked or spotted. Before the skins are fat-liquored it is good practice to sort them according to texture and weight, and not to process heavy and light skins together.

After the coloring operations are completed the skins are washed off, and struck out or pressed as dry as possible, and yet retaining some moisture. A suitable pin mill drum is heated with live steam to about 140 degrees, the condensed steam drained off and the leather thrown into the drum. The drum is set in motion and the skins drummed therein for five minutes so as to warm them up. Then the fat-liquor is added, a gallon or two at a time, until the necessary quantity has been given to the skins. The drum should be supplied with a funnel attached to the hollow gudgeon, so that the fat-liquor may be added without stopping the drum. A fat-liquor that imparts great softness to the skins, may be made of twenty pounds of alkali soft soap and forty pounds of English sod oil in fifty gallons of water, thoroughly emulsified. The soap should always be boiled first in a few gallons of water, then the oil added, and finally enough water run in to make the fifty gallons. The fat-liquor should be used hot, at a temperature of from 120 to 160 degrees, and about two gallons used for each dozen small skins.

A very good fat-liquor is made as follows :

Ten pounds of soap, four gallons of neatsfoot oil and six pounds of egg-yolk in fifty gallons of water. Before the egg-yolk is added the temperature of the soap and oil emulsion should be reduced to about ninety degrees, in order to prevent coagulation of the albumin of the egg-yolk.

From two to three gallons of this fat-liquor are also required for each dozen skins, and sometimes more. Fine light skins may also be fat-liquored by the use of one pint of egg yolk and one-half pint of olive oil for each dozen skins. Any excess of water should be guarded against in the leather, as too much moisture prevents the uniform absorption of the fat-liquor. After the fat-liquor has been applied to the skins, they should be drummed therein for twenty to thirty minutes, after which they should be laid in piles or thrown smoothly over horses for twenty-four hours, so that the fat-liquor taken up will have an opportunity to combine with the leather fibres.

Striking out.

The skins should next be struck out upon the grain and given a light coat of glycerine and water, equal parts of each. This is put on with a rag or sponge and applied evenly over the grain. This gives a smooth, soft feel to the leather, and helps in the final finishing. The next step is to again strike the skins out, and to apply to the grain a light coat of oil. The skins should be very thoroughly struck out, all wrinkles and marks of the machine or tool removed and the grain laid down flat and smooth. The oil that is applied is the last of the subsequent finishing, and should be of good quality, free from any tendency to gum or spew. The water should be well pressed out of the leather before the oil is applied, so that the latter can readily penetrate into the body of the skin, where it will remain and add strength to the fibres. The next operation is the drying out of the leather. After this the skins are dampened and worked soft by staking, and the staking and drying are repeated until the leather is sufficiently soft and perfectly dry. It is generally best to dry colored leather in a darkened room, as strong light frequently causes the colors to fade. The skins should be dried out rapidly in a moderately warm room. After drying and staking the leather is ready for the operations of glazing or ironing.

GLAZING AND FINISHING.

A great many leather finishers buy their seasonings instead of making them. Levant inks are a very superior class of finishes, and may be obtained in great variety suitable for all the various kinds of leather. They are not injured by frost, and produce excellent results. In finishing skins into dull finish, they are given a coat of the seasoning, and this is well rubbed into the leather. While slightly moist, the skins are rolled or ironed. Sometimes the seasoning and ironing are repeated. The grain is thus made soft and smooth. For light-colored leather, a colorless seasoning is used, while upon black leather black seasonings are used, and by reason of the logwood and nigrosine they contain, the color of the leather is deepened and improved. In many instances the grain must be cleared of greasy matter. For this purpose, a solution of vinegar and bichromate of potash is used; also a dilute solution of lactic acid. To ten gallons of water, two or three gallons of vinegar and a few ounces of the potash may be added. Or, to four gallons of water, one gallon of lactic acid. Either of these solutions produces good results, applied before seasoning, and well rubbed into the grain of the leather. After drying, the leather is seasoned either with the prepared seasoning or with the liquor that the finisher prepares himself. On black leather, a seasoning made of the following ingredients and in the proportions named, produces a bright, clear, glazed finish: Prepared blood, one gallon; strong nigrosine liquor, one-half gallon; blue-stone, one-half gallon; iron, one ounce; logwood, one-half gallon.

This liquor may be diluted or used without dilution, as circumstances require. Two or three coats of the liquor are usually required to get a perfect finish, thoroughly rubbed into the leather, dried and glazed between each application. It is important that the seasoning be well rubbed

into the leather, the contrary of this often causing a gray bottom to the finish. Another seasoning liquor may be prepared by blacking five gallons of logwood liquor with a few ounces of copperas. To this are added one and one-half pints of blood, five ounces of glycerine and eight ounces of ammonia.

To glaze colored leather, the following seasoning may be used: Ten gallons of water, one-half ounce bichromate of potash, two pints of acetic acid, and two gallons of egg albumen solution. This is good for the first seasoning. For the second seasoning, ten gallons of water, six gallons of blood and four pints of vinette produce good results.

The skins should be perfectly dry before any attempt is made at glazing them, and if they are warm as well as dry, the finish will come up very bright and clear with little machine work. The less seasoning or glazing liquor is used to make a bright, clear finish, the better it is, as the leather stands handling and wetting better than when large quantities of seasoning are applied. After the glazing is completed, the leather may receive a light coat of oil, the quantity used depending upon the condition of the leather. Very little oil is used, the skins being merely wiped over with an oily sponge or rag. The results of this light oiling are that the finish will stand moisture better than when no oil is used. The oil should be of good quality; low grade oils frequently cause injury to the leather by reason of decomposing in the leather and spewing out upon the surface in the form of white greasy spots that damage the finish. This light oiling completes the process, and the leather is ready for the market.

A PROCESS FOR KID GLOVE LEATHER.

Kid-glove leather of very fine quality and strength may be made by applying the following formula to the prepared skins: Five pounds of alum, two pounds of salt, twenty

pounds of wheat flour and twelve pounds of egg yolk, for each one hundred pounds of skins drained and weighed after the final washing. The ingredients are made into a paste-like liquor with twelve gallons of lukewarm water, and applied to the skins in a drum. The skins are drummed in the same for one hour, or until they have absorbed all the ingredients of the paste. They are then hung up and dried out and left in the dry condition for some months before they are worked out and finished. By being stored away, the skins become thoroughly tanned and eventually work out into very superior leather. In the place of the egg yolk, the soluble oil known as Turkey-red oil may be used with good results. Some carbolic acid, salicylic acid or tar oil may be added to the oil solution to prevent the heating of the oil-stuffed skins while they are stored to cure. Skins treated as above may be finally worked out and finished into glove material without further tanning. They may also be moistened and washed in warm soft water and re-tanned in a drum with a one-bath chrome liquor, then colored and finished as chrome leather. No fat-liquoring is required after the chrome tanning, as the leather works out very soft and strong.

Kid-glove leather may also be made by tawing

The skins with alum and salt, or sulphate of alumina and salt, in a drum, and then, without removing the skins from the drum, applying to them the chrome liquor. After chrome tanning, the skins should be thoroughly washed, colored and then fat-liquored with a mixture of olive oil and egg yolk and flour. A fat-liquor of soap, oil and flour may also be used. The Turkey-red oil may be used as a fat-liquor upon chrome-tanned skins also.

Skins from which the grain has been removed after liming,

Such as mochas, etc., may be readily prepared for tanning into leather by being drenched in a drum, in a solu-

tion of lactic acid, one gallon of the same mixed into one hundred gallons of warm water, 90 degrees F. The drenching consumes from twenty minutes to one-half hour, and the skins may then be washed and are ready for tanning. The methods of tanning that have been described for tanning skins with the grain on may be applied in the same manner upon skins from which the grain has been removed.

The essential qualities of glove leather are softness, fineness of texture and strength. These are largely obtained by the methods employed in preparing the skins for tanning, liming, drenching, etc. The liming should be long and thorough, and the bating or drenching also.

CHAPTER IX.

DONGOLA AND INDIA-TANNED GOAT AND SHEEPSKINS.

DONGOLA TANNED GOAT AND SHEEPSKINS.

VERY desirable leather is made by what is commonly called the Dongola process, or tannage. This tannage is especially applicable to sheep and goatskins, and produces from the former a leather that very closely resembles genuine goatskin, although of course sheepskin leather, no matter how skillfully it is tanned, never possesses the qualities that distinguish goatskin leather. The dongola tannage usually consists of salt, alum and gambier, although other tanning materials are sometimes used in place of the gambier. Palmetto extract, one of the newer tannins, is a good substitute for gambier, as it produces soft, tough and well filled leather at less cost than when gambier is used. Owing to the fullness and firmness of dongola leather, this leather has always been and is now a desirable one to be used in the tops of shoes, where a stand-up quality is especially desired. Only the better grades of sheepskins are used for this class of leather, that is, skins of considerable size and good substance, and with a fine, smooth grain.

Soaking.

As in all other processes of tanning pelts or skins, the first operation is soaking. Sheep pelts are generally not heavily salted, and consequently do not need long soaking, from ten to fifteen hours being usually sufficient. After the pelts have been soaking for a few hours in the water, a good practice is to haul them out and let the dirty and salty water drain off, then to soak them for a few hours

longer in clean water. This procedure thoroughly softens and cleanses the skins. Before the pelts are depilated the water should be well gotten rid of either by draining or by extraction.

Goatskins are usually received by the tanner in dry and dry-salted condition, and require longer and more thorough soaking than fresh-salted skins. The dry-salted skins are readily softened in about twenty-four hours. The procedure described above of soaking the skins for a few hours in clean water, then changing the water and soaking the skins for a few hours longer is a good practice to follow in preparing salted goatskins. The flint-dried skins are somewhat more difficult to soften unless some article is used in the water to assist in the soaking. For this purpose a small quantity of sulphide of sodium is an advantage, as by its use the dried and withered skins are soon brought back to the natural soft condition and freed from salt and dirt and the grain made bright and clear. The importance of the soaking process is often overlooked, and yet it is really a process of much importance, coming as it does at the very beginning of the work, when neglect or wrong treatment will cause trouble later on. The soak-vats should be frequently cleaned out and fresh water run in, as this has much to do with getting leather with bright clear grain and with plumpness and fullness intact.

Preparing the Skins for Tanning.

To get the softness and smoothness of grain that are so desirable in this class of leather, the processes of liming and preparing the skins for tanning need to be well understood, as much of the quality of the leather depends upon how these processes are carried out. Red arsenic limes are very satisfactory to use in preparing goatskins, as they produce just the results desired. Sulphide of sodium mixed with the lime also produces good results, increasing the toughness of the grain and fibre, and giving plump, firm skins.

Tough, firm stock can be obtained by letting the skins lie for two or three days in a clear solution of sulphide of sodium. The strength of the liquor should be about three degrees Baumé, and the skins should be left in the liquor until the hair can be readily washed off. By this process the hair is lost, but the quality and the texture of the leather are very satisfactory. After the hair has been removed the skins may be limed for three or four days in weak, clean limes, or a mixture of lime and sulphide of sodium may be made up in a vat. About one-third as much sulphide of sodium as lime should be used. The liquor should be weak at the start, and gradually strengthened each day. In this instance six days liming will be sufficient. The red arsenic limes are used in much the same manner as the foregoing. The liming is hastened by the paddles, as they keep the skins in constant motion.

The method of depilating sheepskins has been fully described. The pelts are generally painted with either a clear solution of sulphide of sodium or a mixture of sulphide of sodium and lime, and after the wool has been removed the slats are limed for a few days in weak clean limes.

Drenching the Skins.

The bran drench is well adapted for goat and sheepskins to be tanned by the dongola or the combination process, as it rids them thoroughly of all lime and softens the grain and fibres. For about four hundred skins of average size about one-half of a barrel of bran is required. To this is added enough water to make a thick mush. This is allowed to stand for forty-eight hours, or until it becomes sour. This sour bran is poured into a vat holding sufficient water to cover the pack of skins. One and one-half quarts of sulphuric acid and three pecks of common salt are added and the whole mixed together, and heated to about ninety degrees. A paddling in a drench prepared in this way will delime the skins in from four to six hours, thick skins, of

course, requiring longer time than thin ones. At the end of this time the skins will be found to be thoroughly delimed and in splendid condition for pickling or tanning without further washing. If the leather is to be finally colored light and fancy shades, the skins will be improved by washing after drenching for a few minutes in warm water.

Lactic Acid.

Lactic acid is a very satisfactory article to use in the preparation of both classes of skins. After the skins come from the lime they should be washed for a few minutes in warm water and then drenched in a lactic acid bath. The quantity of acid usually required is seldom more than three quarts for each one hundred gallons of water in the paddle vat. The temperature of the liquor should be about ninety degrees. After the acid has been poured into the vat it should be thoroughly stirred throughout the water and the skins entered. This drench readily dissolves the lime in from one to two hours. At the end of this time the skins may be taken out of the drench and worked on the grain, then washed for a few minutes in warm water and are then ready to be pickled.

Pickling the skins.

A good pickle or skin preserver is made of one hundred and fifty pounds of salt and fifty pounds of sulphuric acid in two hundred gallons of water. When the skins are being placed in this liquor care should be taken to open each skin out and after the skins are all in they should be thoroughly stirred. The length of time required by this process is about six hours, although the skins may be left in longer without injury.

The tanning process.

The tanning may be done in a liquor composed of salt alum and gambier. A gambier liquor of about four degrees

strength is prepared and to this are added ten pounds of salt and six pounds of alum for each one hundred gallons of liquor. This liquor should be strengthened each day until the skins are well tanned, which can readily be discovered by the tanner and depends upon the thickness of the skins.

The process may also be used as a two-bath process by applying first the alum and salt and then placing the skins in the gambier liquor. This may be done by using three pounds of sulphate of alumina and eight pounds of salt for every one hundred pounds of skins and drumming the stock in this solution for thirty minutes, following this with the gambier tannage carried on for a few days until the skins are well tanned. The alumina and salt liquor does not work well upon acid-pickled skins, and hence it is not necessary to pickle the skins when this method is used. If pickled sheepskins are to be tanned, the pickle should be removed from them by a drench of sour bran and salt.

Another dongola liquor for both goat and sheepskins

Is made of thirty pounds of salt and forty pounds of alum, dissolved by boiling in about one hundred gallons of water. One hundred and eighty pounds of gambier are boiled in three hundred gallons of water and the resulting liquor is then mixed with the salt and alum solution. To this are added one hundred and fifty gallons more of water and to this is added one quart of sulphuric acid. These are the proportions for making five hundred gallons of good, strong dongola liquor.

Palmetto extract has peculiar and distinctive qualities. It belongs to the same class of tannages as gambier, and hence is especially adapted to the manufacture of light and soft leathers. It tans very rapidly and produces tough leather, light in color and clear grain. It produces very good results when it is used in connection with the chrome process. Light skins may be tanned with Palmetto in three hours.

*A leather possessing some of the qualities of both chrome
and vegetable-tanned stock*

Is produced by first tanning the skins (both sheep and goat) in chrome liquors and following this with a tannage of gambier or palmetto. When this is done, the skins are taken, after the final drenching or washing, and entered into a weak chrome liquor. To one hundred gallons of water, two gallons of concentrated tanning liquor are added and some salt, and the skins left in this solution until they become well struck with the tanning material. If a drum is used, about two gallons of chrome liquor are given for every one hundred pounds of skins and the skins drummed therein for two hours, then laid in a pile for twenty-four hours. In a paddle-vat, after the skins absorb the tanning material, more liquor is added until the bath contains about four gallons of tanning fluid to each one hundred gallons of water. After being tanned in the chrome liquor, the skins should be washed and then entered into a weak gambier bath and left therein until well tanned with the gambier. The gambier completes the tanning and fills the leather, giving it fullness and plumpness. The skins require to be kept in motion during the tanning, and as soon as the process is completed they should be removed from the liquor, pressed out and left lying in piles for some hours.

Fat-liquoring and currying goatskins.

A suitable drum should be heated with steam to a temperature of 100 deg. and one gallon of oil added for each one hundred and fifty pounds of leather, weighed after pressing and draining. The leather should be drummed in the oil until all the oil is taken up and absorbed by the leather, then removed from the drum and hung up and dried out. After drying, the leather should be again weighed and then wet down in a tub or vat, and placed in piles to become soft and moist. At this point the skins may be shaved if they require it, and then put into the drum with just enough

warm water to soften all parts alike. All excess of water should be drained off and from fifteen to twenty gallons of fat-liquor for each one hundred pounds of dry-weight stock applied to the leather. The temperature of the drum and fat-liquor should not exceed one hundred and ten degrees. Some tannages carry more fat-liquor than others. A much smaller quantity than mentioned above will, in many instances, produce the necessary softness. The drumming of the leather in the fat-liquor should be continued until all the grease has been absorbed by the leather, then the stock should be hung up and dried out again.

A very good fat-liquor for combination-tanned skins is prepared as follows :

Twenty-five gallons of water are put into a barrel. To this are added twenty-five pounds of suitable potash soap, which is boiled until it is thoroughly dissolved. Then about fifty pounds of English sod oil and one and one-half gallons of neatsfoot oil are added to the soap solution and the mixture of soap and oil thoroughly stirred until all the ingredients are mixed well together. Enough water should be added to bring the volume of fat-liquor up to fifty gallons. An emulsion of castor oil and castor-oil soap may also be used ; the quantity of each about the same as in the above formula.

Sheepskins.

Very little fat-liquor is required by sheepskins, less than half the quantity given to goatskins being generally sufficient to make them soft and pliable. With the exception of the difference in fat-liquoring, sheepskins are treated the same as goatskins.

After fat-liquoring, the leather is dried out, and the longer it is left in the dry condition the better will be the quality of the leather when it is finally finished. Before it can be dyed black or colored fancy shades the leather must be moistened back. This is best accomplished by the use of

warm borax water. By the use of such water the leather is readily made soft and pliable, and much of the uncombined tannin removed.

Clearing the grain of grease.

When the grain of the leather is greasy, as it often is, the grease can be removed by drumming the skins in a weak warm bath of lactic acid for thirty minutes, after having been moistened with water. About one gallon of lactic acid is used in fifty gallons of water. This operation not only clears the grain of greasy matter, but also opens the pores of the leather so that the dye can the more readily penetrate. When lactic acid is combined with bichromate of potash it makes an excellent mordant and striker for fancy colors. The proportions to be used are two pounds of the potash and one-half gallon of acid to a barrel of warm water. No mordant is really required on gambier or combination-tanned skins, but a striker is sometimes a help in developing and fixing the color upon the skins. The solution of chrome and acid is good for this purpose, as it gives the color a fuller and more even appearance. The drumming in the weak solution of lactic acid also serves the useful purpose of removing all clouds and marks from the grain. For this purpose oxalic acid is also used; three pounds of the acid in ten gallons of water being enough for two hundred pounds of skins.

Coloring the flesh.

When the grain of this class of leather is dyed black the flesh is generally colored yellow. This is done by moistening the dry leather and allowing it to lie for twenty-four hours to become sufficiently soft. Then one-half pailful of sumac is scalded in a closed vessel for two hours. For one hundred and twenty average size skins (either sheep or goat,) the prepared sumac is diluted with four pails of water, and to this is added one gallon of Lactracine.

The liquor should be warm, about one hundred degrees,

and the leather drummed in it for twenty-five minutes. The stock should then be thrown back upon the pins on either side of the drum and the color bath prepared. One pound of yellow S is dissolved in one-half barrel of water, and after the skins have been drummed in the sumac three or four pailfuls of the color are added for each one hundred pounds of dry weight stock. The leather should be drummed in this for ten minutes. At the end of this time it will be found to be colored through with the yellow and in suitable condition to receive the black upon the grain.

Blacking the grain.

The grain blacking may consist of five pounds of powdered or liquid logwood extract boiled thoroughly in one-half barrel of water. In another vessel are dissolved three pounds of sal soda in five gallons of water, and this solution is added to the logwood liquor, boiled again, and enough water run in to make a total of forty gallons. When this solution is used in this concentrated form it is only necessary to run the skins once through the blacking machine before the striker is applied. When the coloring is done on a table a small quantity of ammonia should be added to each pail of logwood dye. The dye is then brushed into the grain of the leather. Then the striker is applied, the skin struck out and another coat of dye applied, and thoroughly brushed in and the leather then washed off in warm water, struck out and a light coat of oil applied evenly over the grain. A striker is made of four and one-half pounds of copperas, one and one-half pounds of blue vitriol in half a barrel of water. Then the barrel is filled to a total of fifty gallons. When this is used upon a machine twelve pounds of copperas and four pounds of blue vitriol are used to a barrel of water. To the first formula are added one pound of nutgalls and one pound of Epsom salts to each six pounds of copperas and blue vitriol combined.

Coloring the flesh blue.

When a blue flesh is wanted, instead of dyeing the moistened skin in yellow liquor as described, they may be drummed in a solution of logwood and drummed until the color is well taken up and has evenly penetrated the leather. When the color is fully developed upon the grain the skins are spread upon the table and the striker applied to the grain side only. This procedure leaves a blue flesh and black grain.

Clearing the grain for colors.

The sumac which is used as a mordant for the yellow flesh color may also serve the purpose of a mordant for any shade that may be desired. There is always more or less uncombined tannin upon leather that has been tanned in any vegetable process, and this frequently causes spots and streaks upon the leather. To overcome this the skins after the drumming in the sumac liquor should be given two ounces of antimonine for each dozen skins and drummed fifteen minutes longer, then washed off and colored with the aniline dye. The use of the antimonine overcomes the uncombined tannin and also clears the grain, as well as acts as a fixing agent for the dye.

Finishing the Leather.

After the leather has been colored or blackened it should be washed off with warm water and given a thorough setting out with a glass slicker. A light coat of glycerine and water should be applied evenly over the grain, and this should be followed by a light coat of neatsfoot oil, after which the leather is again dried out. The final finishing processes consist of dampening, staking and drying, after which if the leather is to be given a dull finish it is ironed, and if it is to be glazed it is polished on a machine. The final oiling off which protects the finish from moisture may be a mixture of neatsfoot and olive oil, one-half of each, or olive oil foots may be used alone.

THE COLORING AND FINISHING OF INDIA-TANNED SKINS.

In the preparation of India-tanned goat and sheepskins for any process of coloring and finishing, it is of great advantage to thoroughly wash the skins. This is done to soften them, and to remove from them all loose particles or excess of tannin, particles of dirt and dust. Before the actual process of washing is begun the skins may be softened in warm water, by being dipped into the same, and then left in piles for a number of hours to soften. They are then transferred to the drum and washed. The water should be at a temperature of ninety degrees; and its efficacy is increased by the addition to it of some alkali such as borax or washing soda, in quantity about two pounds for one hundred gallons of water. In water thus prepared the skins are washed for twenty minutes, then the water is run off and a fresh supply run into the drum and the drumming and washing continued for another twenty minutes.

Retanning with sumac.

A great many of this class of skins are imperfectly tanned, of a dark color and very hard. In order to complete the tanning and to improve the quality of the leather by making it fuller, softer and more readily adapted for fancy colors, it is necessary to take from them part of the original tanning material and to replace it with some other tannage. Sumac is frequently used for the retanning. A good method to pursue is to wash the skins thoroughly as above directed in warm borax water for thirty minutes or longer, then to wash them off in clear warm water, and to pass them through a weak bath of sulphuric acid and water. The borax or soda used in washing darkens the color of the leather; the acid treatment brightens up the color. After the acid treatment, the skins should be washed with an abundance of water and then retanned with sumac.

The retanning with sumac is done preferably in a drum.

The liquor should be warm, at a temperature of about one hundred degrees; and from one to two pounds of sumac used for each dozen skins. The skins may be run in the sumac liquor for two or three hours, washed off in water to remove surplus sumac liquor, and set out on the table with a slicker, and may be either dyed at once or hung up and dried out before being colored.

Alum, salt and gambier liquor.

Instead of a retannage in sumac, very good leather may be made by applying to the skins an alum, salt and gambier liquor, thus producing leather that very closely resembles dongola leather. Palmetto extract may also be used as a retannage, and produces results similar to gambier. The leather is very much improved by the retanning. Other tannages may be used in place of those mentioned. Quebracho makes very soft leather, and also works well combined with hemlock and other extracts.

For black leather.

For black leather the skins may be lightly washed in clear water, pressed and fat-liquored with a light emulsion of oil and soap, then hung up and dried out. Or they may be dried out after tanning and then moistened back, blue or yellow backed, fat-liquored and then grain blacked. A drumming in oil immediately after retanning and pressing, before the leather is dried out, one gallon of oil for every one hundred and fifty pounds of pressed leather, will keep the grain soft and prevent its cracking or becoming rough during the time it is drying out. Moistened back and ready for flesh coloring, the leather may be colored blue upon the flesh by the use of logwood and borax, purple aniline, or a solution of blue nigrosine. The last named article is used in the following manner: For each dozen skins two ounces of the nigrosine are dissolved in hot water and applied to the skins at a temperature of one

hundred degrees. The leather is drummed in the color solution for twenty minutes, after which it is blacked on the grain, struck out, oiled lightly, and dried out.

When logwood and borax are used

The skins are drummed in a solution of the same until the color is well taken up and absorbed, then spread upon a table or run through a machine, or folded and dipped into a striker liquor in trays or boxes, and the grain by this procedure is made black and the flesh remains blue or purple.

For very light and fancy shades.

When very light and fancy shades are wanted it is oftentimes a great advantage to first bleach the leather as light a color as possible. This may be done by the methods described in the part of this book devoted to bleaching processes.

When the grain of the leather is greasy

It may be cleared by milling the skins in a dilute solution of lactic acid, one gallon of the same mixed with fifty gallons of warm water, previous to coloring. The use of the acid solution opens up the pores of the grain, clears the grain of greasy matter, and thus aids in getting more uniform coloring. After the acid treatment the leather should be washed in water before it is colored.

Practical instructions for the getting of many of the shades of color at the present time in most favor are given in various parts of this book. Aniline and sulphamine dyes are most generally used.

Turkey-red or alizarine oils.

The finisher of India-tanned goatskins may be interested to know that good results are said to be obtained upon such skins, and in fact upon all classes of bark and vegetable tanned leather, from the use of the so-called Turkey-red or alizarine oils, used in place of emulsions of oil and soap to impart flexibility and fineness to the leather. The use of

the oils mentioned has been made the subject of a patent, a full description of which will be found in another part of this book. No reference is made there, however, to this particular class of leather. No doubt good results may be obtained by subjecting the skins after washing and retanning to a bath of the soluble oil, made up in solution about ten per cent. of the oil in warm water—that is, presumably ten gallons of the oil mixed into one hundred gallons of warm water. The skins are passed once or twice through such an oil bath, allowed to drip or drain, and are then slowly dried out. Very fine effects are claimed to be produced by this method of lubricating the leather, whether the same is dyed black with logwood or colored fancy shades.

Another process for finishing India goat and sheepskins.

Another process, also patented, and fully described in another part of this book, is of interest to finishers of India goat and sheepskins, because by its use a superior quality of leather is said to be produced. Upon raw skins the process consists of treating them in a vat or drum to a bath of tanning material in the usual manner, gambier or any other vegetable tannage being used, and then applying to the tanned skins a solution of formic aldehyde. This may consist of three pounds of the commercial formic aldehyde, 40 per cent. to each one hundred pounds of skins, dissolved in about fifteen gallons of warm water. The skins are subjected to the action of this solution until they are permeated through and through with the same and respond to the usual tests of good leather. Upon light skins this is said to consume three hours. The temperature of the liquor should be maintained at from 80 degrees to 120 degrees Fah. The use of the formic aldehyde solution fixes the tannage upon the skins, and after this has been accomplished the leather may be washed and finished in the usual way.

Imperfectly tanned skins may be greatly improved

By the following method of tanning: They are thoroughly washed, and when they require it they are retanned with any suitable tanning extract. They are then given a treatment with formic aldehyde in the same manner as described for raw skins. This thoroughly plumps and fills the leather. In case the skins are well tanned and full and plump to begin with, the retanning is not necessary. The solution of formic aldehyde may be applied directly to the moistened and washed skins in a drum. This treatment is said to securely fix the tanning material upon and in the leather fibres, and results in making a superior quality of plump and well-filled leather. Another advantage afforded by this process is that it overcomes the obstacles hitherto encountered in the use of materials like divi-divi, which add to the leather substances extremely susceptible to fermentation, and which lead to loss of leather in damp weather. The use of formic aldehyde prevents this fermentation and the subsequent softening of the leather. It also prevents the moulding of the leather during the time it is drying out.

The letters patent issued on this process cover the use of formic aldehyde in the making of all kinds of leather, heavy and light, and made by any process or combination of processes of tanning.

CHAPTER X.

PATENTED PROCESSES OF TANNING AND TAWING.

IN this chapter a number of very interesting tanning and tawing processes are described. The intelligent tanner, eager to broaden his knowledge of tanning, can do no better than to study carefully these descriptions. A great deal of valuable information can be acquired by such study.

The following process is a patented "Method of Tawing," designed for the final finishing of East India kips, goat-skins, basils and white leather, and the improvement of hides and skins imperfectly tanned by cutch, tena japonica, divi-divi, etc., so that the required plumpness, weight, color, softness, and moisture-resisting qualities are obtained.

The process consists, essentially, of two steps, the first of which is concerned with the introduction of materials which will render the skin sensitive to the fixing or tanning agent employed in the second step. This results in a fulling or plumping effect, clearing the grain, and at the same time feeding the leather. The first step has the same purpose as that commonly attained by the employment of old and sour liquors and weak solutions of extracts which precede the actual process of tanning.

The second step consists of treating the hide or skin to the action of formic aldehyde, a material possessing the property of fixing the connective tissue and fibers in the swelled and plumped, tawed or partially tanned condition, produced by the first treatment, and at the same time of fixing in, upon or between the fibers materials previously supplied by the first step of the process to contribute special qualities, such as body, color, suppleness, weight, etc., essential to a solid and well nourished leather.

The use of the formic aldehyde in the second step is not a mere aggregation of elements or materials, as it is in its nature and effects entirely different from the materials employed in the first step, and could not be substituted for them to produce the effects of the first step, while it possesses distinctive and positive characters by which it acts upon both the skin and the materials with which it has been impregnated by the first step in a manner peculiar to itself. The formic aldehyde is used in the second part of this process strictly as a tanning agent to render the skin non-putrescible and insoluble.

Advantage is taken of the property possessed by various tanning and tawing agents such as alum, salt, argol, eggs, flour, vegetable extracts, gambier, cutch, and the artificial and natural tannins used in making leather, many of which have none or only feeble tanning properties—of causing a curling up or separation of the fibres, and the deposition therein and upon of materials which prevent them from becoming agglutinated, thereby allowing the interlacing fibres to move readily upon each other, and which at the same time add material to the skin which is of advantage in respect to weight, body, color, etc., whereby a plump, soft, pliable, tough and elastic leather may be produced.

Leather is of so many varied qualities and varieties that it is impossible to specify any one of the agents, such as alum, eggs, flour, extracts, gambier, tannins, etc., as being capable of meeting all requirements which will produce the effect or effects desired.

The following particular case will serve to illustrate the steps involved. Sheepskins, goatskins or hides, having been previously prepared for treatment by softening, unhairing and other necessary steps, usually referred to as "beam-house treatment" are placed in a drum or reel, in which they may be agitated by the revolving of the drum, or the action of the paddles, or by any other suitable means.

In the drum, for instance, is placed a solution of gambier extract sufficiently diluted to present the extract to the entire mass of skins, containing approximately four pounds of gambier to each one hundred pounds of wet hides or skins, the exact quantity of gambier being based upon the weight of the skins or hides to be treated, also upon their acidity or alkalinity, according to the well-known gambier process. The hides or skins are then drummed in the gambier bath until they are permeated through and through by the solution. When the gambier has struck through or thoroughly permeated the skins, which may be ascertained by cutting into the thickest skin and examining the exposed interior, the skins are cleansed in clear water; but this washing may be dispensed with and the second step proceeded with at once.

The second step consists in subjecting the skins to the action of formic aldehyde, preferably in solution, although it may be employed in the state of gas, either in the same drum or vat in which they were given the first treatment, or another drum or vat may be used.

The amount of the solution employed varies somewhat, but is based upon the weight of the skins to be treated, and it has been found in practice that three pounds of commercial forty per cent. formic aldehyde solution to each one hundred pounds of wet hides or skins is sufficient for ordinary sheep or goatskins. The amount of water with which the formic aldehyde is diluted is based upon the bulk of the skins, being just sufficient to keep them well wetted and to present the formic aldehyde to the entire mass of skins, but not so much as to prevent the pounding action of the skins when revolving in the drum.

The skins are subjected to the action of the formic aldehyde until permeated through and through and until they respond to the usual tests of good leather. In this particular case the time required is three hours, depending to a very considerable extent, as in the treatment by the first

step of the process, upon the number of skins in the drum and the rate and mode of agitation to which they have been subjected.

It is advisable to maintain the bath in the second step at a temperature of not less than 80° Fah. and not above 120° Fah. in order to secure the greatest efficiency from the formic aldehyde. After the skins are found to have been thoroughly fixed by the formic aldehyde, they are washed and are then ready for the usual treatment employed in finishing. In case the formic aldehyde is employed in the state of a gas, the following method is advisable: The skins, having been brought to the desired state by the first step, as has been described, an amount of commercial formic aldehyde solution, representing three pounds to each one hundred pounds of wet hides or skins to be treated, is placed in a suitable generator, and the gas generated is allowed to pass, by suitable connections, into the chamber containing the skins. The temperature of this chamber is preferably maintained at from 110° to 120° Fah., and the atmosphere of the chamber should also be kept moist, both of which conditions are readily secured by the admission from time to time of a small quantity of aqueous vapor by means of a suitable steam connection. The chamber employed should be a closed one, and no larger than necessary to allow the skins to be fully exposed to the action of the gas.

If desired, the gas may be admitted to the drum in which the preliminary treatment took place or into a similar drum, and the skins agitated therein, or the skins may be stretched on suitable frames and enclosed within a stationary chamber, in either case being exposed to the action of the gas until they respond to the usual tests for good leather, say for a period of six hours, the time depending, however, on the thickness and character of the skins under treatment.

The market supplies certain tanned or imperfectly tanned

skins and hides, which have been subjected to the action of salt, alum, flour, eggs, vegetable extracts, gambier, cutch, tannins or other materials, and which do not constitute high-grade leather, but which may be greatly improved. The effects produced on these skins are analogous to those produced by the first step of the process, and it is advantageous to take such skins, and after softening them in water to proceed to treat them as described in the example cited for treating raw skins, whereby the results of the first step are secured with less time and material than is required in the treatment of raw hides or skins. In certain cases where the tawed or imperfectly tanned skins or hides have the plumpness, color, weight, etc., desired, and which would be in other instances secured by means of the first step of this process, the second step may be at once proceeded with, which consists essentially in the fixation of the natural or added constituents of the skins.

It has been found by a large number of practical tests that the action of the natural tannins as introduced into the skin by the first step of this process may be greatly hastened and augmented by the employment of formic aldehyde in conjunction therewith, as accomplished in the second step. Thus with the pyrogallol tannins, a considerable portion of which possess little or no tanning power, a compound is formed whereby all the tannin is rendered available, and consequently a greater action secured from a given amount of extract, a matter of importance in point of economy. Again it has been found that by means of formic aldehyde used in conjunction with, but subsequent to the use of those natural tannins containing "reds," as introduced into the hides by the first step of this process, these substances, which in many instances are insoluble and not directly available for tanning, can be fixed in the leather; and again with other tannins the deposit of "whites" or "bloom" is prevented. The peculiar action of formic aldehyde upon the fibres of the skin results in filling the skins—plumping

them, thereby effecting what is commonly known as feeding the leather.

A special advantage afforded by this process is that it overcomes the obstacles hitherto encountered in the use of material like divi-divi, which add to the leather substances extremely susceptible to fermentation and which lead to loss of leather in damp weather. The superior bactericidal and anti-fermentative properties of formic aldehyde prevent this fermentation and the subsequent softening of the leather. It also prevents molding during the drying of the finished leather.

Formic aldehyde has the property of fixing the collagen and other gelatinous constituents of the skin in the condition in which they are when subjected to its action; and it has been found to be highly advantageous in using formic aldehyde in the manufacture of leather to prepare the hides or skins by some preliminary treatment of tawing or tanning. The skins may be alum, oil, chamois, chrome or vegetable tanned in the first part of the process, and then taken ready prepared and submitted to the fixing action of formic aldehyde.

Patented by Messrs. Dolley & Crank, Philadelphia, Pa.

Sulpho-Compounds or Their Mixture with Fats and Oils.

In tanning leather of the various kinds and by the various processes the use of oil plays an important part, and the same has been applied in various ways, though principally as an emulsion with alkalies or their carbonates, or as an emulsion containing a free fatty acid. It has been found by Armand Müller, of New York City, that the whole tanning process may be greatly improved, shortened and simplified by the use of sulpho-compounds, or mixtures of the sulpho-compounds of the various fats and oils with fats or oils or free fatty acids—that is, by the use of the so-called “Turkey-red oils” or “alizarine oils.” These oils are used in this process of tanning in place of fats or oils, or emul-

sions of oils or fats, whether in bark-tanning, alum-tanning or tawing, oil-tanning or chamoising, chrome-tanning, or any other in which oil or its equivalent is used.

The materials present ready means of effecting the proper absorption of oils and fats, in the shortest possible time, in the most rational manner and with a considerable saving of material. This refers as well to the manufacture of common tanned leather—that is, to ordinary bark-tanning, as to tawing and chamoising. Furthermore, the great advantages are presented that combinations may be effected that insure the tanning materials being more firmly fixed upon the fibre, resulting in much tougher leather. The benefit derived from the use of these oils is due to the fact that they are soluble in water, contain large quantities of undecomposed or unchanged oil, or free fats, or fatty acids, and present these in a manner and condition to permeate the skins with great ease and uniformity, thereby also effecting great saving in material and labor.

The oils or sulpholeates are to be produced in the well-known way, by the gradual action of twenty-five to fifty per cent. sulphuric acid upon triglycerides, oil-seeds, etc., as well as upon semi-liquid and fixed fats, with neutralization of the resulting acid sulpho-mixture by means of potassium or sodium hydrate, or ammonia.

A few examples of the methods of using the sulpholeates in tanning leather are given. First proceeding, upon hides to be bark tanned. The well cleaned and properly swelled hides are placed in a neutral, five to seven per cent. sulpholeate solution. After the expiration of a few hours they are to be taken out, allowed to drip and to dry in the air or in a damp heated chamber, whereupon after complete drying they are washed, and the operation is repeated to completion. The remaining oil preparation can always be employed anew, without particular addition thereto. The hide thus prepared and nearly tanned is next placed in the tan vat in the usual manner, or may be subjected to any other process, as to a process of quick tanning.

The hide with the usual quantity of tan stuff absorbed is tanned in half the time, is much better in quality and never brittle. The leather is now treated as usual, and fattened or oiled, though again in place of oil, fat or degreas a six (greater or less) per cent. sulpholeate solution may be employed, and finally the hide is dried and washed. The washing, however, may be omitted. Second proceeding: The raw hides are softened, cleaned, swelled and tanned in the usual manner, and then instead of being smeared or stuffed with fats, oils or degreas they are passed through a seven to ten per cent. solution of the oils in lukewarm water, whereupon they are allowed to dip and are then slowly dried. The leather is then at once bark-tanned and may be colored with logwood with much finer effect than ordinary leather.

Alum-tawing with Turkey-red Oils.

The skins tanned by the usual process of tawing have the disadvantage that by water a part of the alum clay or argillaceous earth is withdrawn from them, whereby their strength is much reduced. This evil can best be overcome by the application of the sulpholeates, either before or after the actual tanning with alum and salt. The leather acquires by this treatment increased solidity, coupled with flexibility and softness and a finer appearance. The sulpholeate solutions are admirably adapted to replace the egg-yolk used in the manufacture of kid gloves. To the oil solution, according to the French method, some phenol (carbolic acid) is added, although many other suitable soluble substance, such as salicylic acid, tar oil, etc., may be employed to counteract the too strong heating of the stuffed skins when laid or spread or stored to cure. The sulpholeates may also be used in the chrome process, resulting in increased solidity and toughness, together with softness and pliability, than results from the application of soap solutions.

Oil-tanning or Chamoising.

The skins prepared in the usual manner are passed through a twenty-five per cent. Turkey-red oil solution, whereupon they are allowed to dry, are laid in a moderately warm room in a heap and are carefully covered up. They are then hung up in the air and allowed to dry slowly, when they are again oiled in the same solution after they have been laid in lukewarm water to rid them of any adhering unchanged alkaline sulpholeate, are filled, again laid in a heap, again dried, and then treated with a weak solution of alkali. The dried leather is then stretched and rubbed to give it flexibility, which has been somewhat lost in drying, and is then completely oil-tanned.

The results may be variously modified, by greater or less concentration of the Turkey-red oil solution, by higher temperature in drying, as also by more frequent passes or dippings. In all cases the absorption of the fats and fatty acids takes place sooner, more evenly and with greater certainty than in the ordinary procedure; and there is no loss of fat, because the remainder of the solution may be applied with equal effect upon a fresh lot of skins. Combinations with the salts of alumina may also be employed here.

The method preferred is as follows: Steep the prepared skins in a solution containing preferably fifteen per cent. of the soluble oil; dry, and if necessary repeat the operation, and then proceed in the usual manner of tanning, according to the kind of leather wanted.

This process of alum tawing

Has for its object the facilitating of the process of tanning by reducing the time consumed, and to leave a salt in the skins that will form a basic mordant for the coloring matter, and at the same time, when the skins are finished, they will be soft, flexible and waterproof.

The skins are treated in the usual manner to remove the hair or wool, limed, bated and washed, and thus made soft

and flexible. A solution is then made of from twelve to fifteen gallons of water, to which have been added nine pounds of alum, two pounds of salt, and thirty pounds of wheat-flour, the whole being thoroughly agitated while subjected to a heat of about 82.4° to 86° Fah. for fifteen minutes. To the solution are added about twelve pounds of the yolks of eggs, and the solution is agitated for another five minutes.

The mixture is then placed in a suitable drum capable of holding about one hundred pounds of skins, and the whole allowed to revolve for from thirty to sixty minutes, or until the skins have absorbed the contents of the drum. This completes the first step in the process, and is what is commonly known as "tawing." The skins are next removed from the drum, and hung up and dried out. Next a solution of sal soda is made, composed of one pound of soda to a gallon of water. In a sal soda solution made up in these proportions, and in quantity sufficient to treat the lot of skins, the skins are placed until they are thoroughly soft and flexible, and have assumed a neutral condition. They are then washed in lukewarm water to remove all foreign matter and traces of soda, and are then placed in the following bath: This bath is made by adding sulphuric acid to water until the mixture assumes a density of one to two degrees Baumé. To this solution is added as much of hydrated sesquioxide of chromium or chromic hydrate as will dissolve, and no harm is done when there is a surplus of chromic hydrate remaining in the vessel. Should the solution not be neutral, it may be made so by the addition of sal soda until this result has been accomplished. The skins having been neutralized as above mentioned, and afterwards washed, are placed in the chromium solution, and the whole agitated for from five to fifteen hours. They are then removed, washed, colored and finished in the usual way.

The mordant in the skins when combined with the sub-

sequent coloring matter permeates the entire fibre of the skins, and greatly adds to the lasting quality of the color and durability of the leather. This process has been patented by Messrs. A. Warter and H. C. Koegel, of Newark, N. J., who claim as new a tawed or alum tanned skin subsequently impregnated with the sesquioxide of chromium.

The use of formic aldehyd as a tanning agent

Is not generally known among tanners; and yet leather is made with this material, the use of which is not complicated or uncertain, but on the contrary very simple and safe. This process of tanning with formic aldehyd relates particularly to goat-skins, but there is no reason why the process cannot be applied with equally good results to other classes of skins, and even to hides. The skins are subjected to the treatment with formic aldehyd in such a manner that they become thoroughly permeated with it, the result being that the gelatinous constituents of the skins are rendered insoluble and otherwise chemically changed from raw skin into leather.

The skins are prepared for the process of tanning in the usual manner of soaking, liming and bating or drenching, and are then subjected to the action of formic aldehyd in its natural gaseous condition or in aqueous solution; the strength of the solution and the degree of concentration of the gas and the length of time consumed by the treatment varying according to the character and thickness of the skin.

When the formic aldehyd is used in the form of a solution, the skins are treated at the beginning of the process to a three per cent. solution of the material, and in this solution the skins are treated in a closed drum for about ten minutes. At intervals of ten minutes formic aldehyd is added to the skins in the drum until at the end of one hour enough of the material should have been added to have

brought up the strength to ten per cent. In this way the skins are treated to a liquor of gradually increasing strength. For ordinary goat-skins a period of one hour is sufficient to tan them thoroughly. During the process the skins can be subjected to the ordinary tests made by tanners, and should always be left in the solution and drummed until the thickest portions indicate thorough conversion into leather, by losing their raw feel and appearance and becoming colorless and leathery to the touch.

When the formic aldehyd is used in a gaseous state the skins are suspended in a chamber that can be hermetically sealed, and that can be connected with any suitable form of apparatus for generating formic aldehyd gas. The skins being suspended within this chamber, and the door closed, the gas is introduced, and the skins subjected to the action of the gases or mixed gas and vapor, until the ordinary tests indicate that the skins have been thoroughly permeated with the tanning agent. As many ordinary prepared goatskins as can be suspended in a tight chamber having a capacity of about two thousand cubic feet may be thoroughly tanned within a period of from six to ten hours, by the action of the quantity of formic aldehyd gas generated by the ordinary process from one pint of wood alcohol. The formic aldehyd may also be employed in the gaseous state by the vaporization of an aqueous or alcoholic solution, and when used in this way it is deemed desirable to add a proportion of chloride of calcium to the formic aldehyd solution. For this purpose two hundred parts of chlorid of calcium for each fifteen hundred parts of formic aldehyde solution suffice. In case the gas is employed in connection with aqueous vapor, live or heated steam is not employed, but rather a cool vapor or moisture charged atmosphere.

It sometimes occurs that a pack of skins by reason of their unusual thickness, or from any other cause may require a strength of the tanning solution differing somewhat

from that employed in tanning ordinary skins, and it is at once evident that in such case the tanner may by selecting a fair specimen of the lot and using the same as a test, more readily determine the strength of the solution. Leather that is made by this process of tanning is distinguished from all other leathers by any of the following tests: By coming from the tanning bath free from any discoloration caused by the tanning agent; by its freedom from mineral deposits such as are deposited in the skins in both vegetable and mineral tannages, and by the readily discernible presence of the formic aldehyd in the skin.

The following described process is a French one,

And by its use it is claimed that the cohesion of the fibres is destroyed and putrefaction is prevented without the help or the formation of any crystallizable salt, which would have the effect of reducing the strength of the skins. The result is that skins remain permanently flexible and lose none of the strength they possessed before being treated, nor has water, whether hot or cold, any action whatever on a skin thus prepared. This method makes the skins as firm, as supple and as elastic as may be required. It also leaves the skins white, and when dyed, the colors become rapidly and completely fixed.

After the usual processes of preparing the skins are finished, the skins are immersed in a bath containing one part of sulphite of aluminium to ten parts of water, and they are allowed to remain in this bath from twenty to forty minutes, according to their nature and thickness. Sulphite of aluminium possesses, among other essential properties, those of being both unstable and reducing. On that account the organic compounds contained in the skins are sufficient to determine the decomposition of the said sulphite, thus causing sulphurous acid gas to be given off in the bath or tank. In reducing the organic compounds contained in the fibres, the said sulphurous acid gas becomes transformed, through

the presence of the water, into sulphuric acid, which combines with the alumina resulting from the decomposition of the sulphite to constitute sulphate of aluminium. The action of the bath is rendered more vigorous by a small addition of hydrochloric acid, intended to facilitate the liberation of the sulphurous acid.

When removed from the bath the skins are allowed to drain for a few minutes. They are then immersed in an ammoniacal bath. The ammonia being a stronger base than alumina, separates the latter from the sulphate and chloride, which thoroughly impregnate the skins. The skins thus receive the alumina in the form of gelatinous precipitate of hydrated alumina. The skins are taken out after a few moments and left to drain. The proportions of the second bath necessary to produce the precipitation are, twelve parts of water to one part of ammonia solution. Upon the completion of these operations, in order to dress the skins, they are caused to absorb within fulling mills a firm paste, constituted of eight parts of wheat flour to one part of glycerine, to which latter is added a small quantity of the precipitate of the ammonia bath in order to obtain a sufficiently firm paste. The paste should be completely absorbed before the skins are removed from the fulling mills and before they are dried out, if they are intended to be used in a white condition or before drying them, which operation may be undertaken at once without further preparation. The skins are then finished in the usual manner.

The inventor of this process claims for it that it makes leather that is waterproof, elastic, pliable, heat and frost proof,

That is to say not readily affected by heat or cold. It consists simply of a two-bath process of chrome tanning, in which neatsfoot oil is used both in the first and second bath.

The first bath to which the prepared hides or skins are subjected is a solution of bichromate of potash—five pounds for every hundred pounds of hides or skins, and two and

one-half pounds of sulphuric acid. To these ingredients mixed with the quantity of water required, is added five per cent. of the weight of the hides or skins of neatsfoot oil. In the solution prepared of the above ingredients the hides or skins are treated in a drum until the liquor has entirely penetrated them.

The second part of the process is a bath of hyposulphite of soda mixed with sulphuric acid and neatsfoot oil in the proportions of ten pounds of the hyposulphite of soda, seven and one-half pounds of sulphuric acid and five pounds of neatsfoot oil for one-hundred pounds of hides or skins. Upon coming from the first bath the skins are subjected to the second bath either in a drum or a paddle-vat, after which they are washed and dried out. The hides or skins may also be treated with the liquor of hyposulphite of soda, acid and oil as a first bath, and then afterwards to the solution of chromic acid and oil.

In using the named articles in connection with neatsfoot oil, it causes the chromic acid to be reduced to chromic oxide, as the oil becomes oxidized by mixture with the chrome compounds, and forms in this way a new insoluble compound that penetrates the fibres of the skins to complete the tanning or tawing effect, and makes the leather more pliant and waterproof.

Patented by Chas. Knees, Oshawa, Canada.

New Method for Belt, Shoe and Leather Laces.

The description that follows relates to a new method of making leather, especially adapted for belt, shoe and leather laces, by the chrome process. This is a patented process, the patentee being one James C. McConnell.

The hides are treated in the preparatory process of liming, unhairing and bating the same as any hides are treated for a chrome process. The first step in the making of the leather consists of drumming the hides in a drum, or paddling them in a vat in a solution of alum and salt. This

is made up of two pounds of alum and four pounds of salt for each one hundred pounds of hides. In this liquor the hides are treated until they have absorbed the same. The hides carry sufficient water as they come from the washing process to absorb the alum and salt. After this treatment the hides are allowed to press, drain and partly dry, when they are split and shaved. The tanning is then completed by drumming the hides, or paddling them in a vat, in a chrome or mineral tannage of any kind, after which they are washed and again partly dried to get them in proper condition for fat-liquoring or stuffing.

The stuffing mixture is prepared as follows: Four ounces of common potash, or other alkali, are boiled in one-half gallon of water until dissolved. Then two pounds of any good degreas and four pounds of tallow are added, and the whole brought to a quick boil. The compound requires to be thoroughly cooked. Then one-quarter gallon of neatsfoot oil is added, and the compound stirred until the temperature reaches a little below boiling-point. Then the compound while hot is applied to the leather, the quantity named being used for one hundred pounds of leather, at a temperature of 150 degrees F.

After the leather is stuffed it is set out and oiled off on the grain side with a light coat of neatsfoot oil, then stretched in frames until thoroughly dry. After this it is moistened and staked and softened, and the staking, working and drying are continued until the leather is soft and dry. Then it is coated on both sides with a light coat of paste made with tallow, starch-flour, soap and water boiled together. Then the leather is dried out again and finished in the usual way. As is the case when alum and salt are used before the chrome process is applied, the object of using them is to pickle the hides so that they will not draw or pucker when put into the tan liquor, and to preserve them so that they can be kept some time before they are chrome-tanned. By first tawing the hides in alum and

salt, and splitting them before they are chrome-tanned, a saving of chrome materials is effected. An interesting feature of this process is in the fact that the salt and alum treatment permits the leather to be stuffed at a high temperature, thus insuring a more thorough penetration of the stuffing greases than is usually the case, and the leather is made very elastic and durable, and peculiarly suitable for lace leather.

Lace leather, made by a chrome process in this way, does not harden, but remains strong, soft and pliable until it is worn out. The stuffing is done in a warm drum, and all the ingredients must be completely incorporated with each other and thoroughly taken up by the leather before it is dried out.

Process with bark liquor, saltpetre, alum and glauber salt.

Among the various processes that have been brought forward for the purpose of tanning leather with bark liquors in less time than is commonly consumed, is one by which the bark liquor is supplemented by a solution of saltpetre, alum and glauber salt.

It is well known that by the older methods of tanning the hides, after the hair has been removed, are placed in weak liquor, and for a period of from three to four months, are left in the same, with more or less frequent handling and changing of the liquor, until finally they are tanned. Much care has to be exercised lest too strong liquor be used, in which case the tannic acid of the same will act upon the grain of the hides, rendering it crisp and brittle, materially impairing the value of the leather. By combining the above-named chemicals with bark liquor, they unite with the liquor in such a way as to render the action on the gelatine and fiber of the hide harmless, and at the same time admits of the hides remaining in the vats in which they are first placed until they are completely tanned.

The tanning liquor is prepared in sufficient quantity, either from oak or hemlock bark, of 18° or 20° strength of the barkometer to cover fifty skins, this being the usual number placed in each vat. To the liquor is added a solution made as follows: Four pounds of saltpetre, four pounds of alum, and five pounds of glauber salt, dissolved in hot water. After this solution has been added to the bark liquor, the skins are placed in the mixture, the skins and the mixture being agitated once an hour for the first twelve hours. After this has been done, the skins may remain in the liquor six days, unless they are very heavy, in which case they may remain eight days in the vat, at the end of which time they will be found to be thoroughly tanned. They are then to be washed, dried and finished in the usual manner, unless they are to be sold in the rough or made into sole leather, in which case they should be rinsed in a vat containing sufficient water, to which are added three pounds of cream of tartar. This does not enhance the value of the leather more than to give it a nice, clean, bright appearance.

Patented by J. W. Hitt, Lisle, N. Y.

This process of tanning consists of the use of an antiseptic tanning composition

For leather intended to be used as a lining for horse collars, all kinds of harness pads, and similar appliances. To make such hides more appropriate for this particular purpose, the hair is not removed from the hides, because resting next to the skin of the animal they form a soft bolster, are cool because this hairy layer permits free evaporation and escape of the perspiration, keep as a consequence the harness dry, and protect it against mold and rot, and finally, by their softness prevent the growth of sores on the animal.

To tan and prepare hides for such linings, so as to keep them from rotting from constant contact with the moist

perspiration ; to make them soft and tough ; to preserve the roots of the hair in a manner to prevent the same from falling out ; to render them harmless and salubrious by proper medical and antiseptic treatment, and to keep moths and other insects out, has been fraught with many difficulties.

In the first place all fatty substances which might tend to cause fermentation and rot must be eradicated ; secondly, to make and keep the leather pliable and to prevent the perspiration of the animal from entering and saturating the same, setting up fermentation and causing rot, its pores must be filled with an unctuous and preserving substance ; thirdly, the pores of the hide should be contracted to toughen the leather, and also to guard against all possibilities of any of the hair falling out, and, lastly, the odor caused and remaining from the tanning process should be eliminated. The means selected to comply with all these conditions must be of such a character as to be not only harmless to the skin of the animal, but in addition should have such medical and antiseptic qualities as to prevent sores, to heal them and prevent their spread in cases where they exist, and finally they should harden the skin in places where the pads are in constant contact and bear on it.

To fulfill the first condition, corrosive sublimate is the most suitable means. It acts as an antiseptic and germicide by killing or neutralizing all such matter which might cause decomposition. For the second requirement phenol (carbolic acid) or the preparations derived therefrom are used. It or they fill the pores of the hide, and by unctuous properties keep the same soft and pliable. The third condition is best complied with by the application of salicylic acid, which contracts the pores of the hide and toughens it. The fourth condition is satisfied by menthol, which by its penetrating odor eliminates the scent of the tanning process adhering to the hide.

In cases where pads lined with leather so prepared come in contact with sores on the animal, the corrosive sublimate, in combination with the phenol contained in the pores of the lining, will stop the spread of the sores, and by virtue of the antiseptical and germicidal properties of these drugs will heal the sores and prevent their recurrence. In addition to the named effects on the skin of the animal, these drugs in combination with the salicylic acid will also harden the same. Hides so saturated are fully germ and moth proof, because the drugs used in their treatment are inimical to insect life.

The chemicals named may be applied by adding them to the ordinary tanning liquor prepared from sumac or bark in which the hides are immersed, and in which case the procedure is the same as the usual tanning process, or they may be applied as a dressing by means of a brush after the ordinary tanning process has been gone through with. The temperature of the composition is preferably from 60° to 70° Fah. The menthol in a solution of five parts dissolved in ninety-five parts of alcohol is best applied separately and lastly in the form of a spray. As regards the proportion of said chemicals, one part of corrosive sublimate, eight parts of phenol, and one part of salicylic acid, all dissolved in sixty parts of water, produce the best results. The quantity of water may be varied, however, in order to produce a more or less concentrated solution, by the strength of which the duration of the tanning process may be lengthened or shortened. Equivalents may of course be substituted where they produce the same results. For instance, boracic acid may be used in place of the corrosive sublimate, and also instead of the salicylic acid. For the phenol any of its species may be used.

Hides or leather so prepared preserve remarkably well, and are rendered exceedingly tough and tenacious without losing their pliability and softness.

The preparation, if mixed with the ordinary tanning

liquor, will hasten the whole tanning process and keep said liquor from getting sour or spoiled.

Patented by Julius Engelke, Cincinnati, O.

The following process of rapid tanning

Is a patented one, the patentee being one John Hoelck, of Chicago. The object of this process is to accelerate the operation and to reduce the cost of manufacture, and at the same time produce a leather the quality of which is superior to any tanned leather on the market. The usual results of any attempts to hasten the process of tanning are that the quality of the leather is injured more or less. The hides to be treated by this process are handled as follows: They are soaked in clean fresh water over night. Then they are fleshed and washed in the wash-wheel in order to remove from them the salt and dirt, and are then again put into clean water, and left therein over night. The hides are then tied together head to butt, though when intended for belting, the heads and bellies may be cut off and prepared for sole leather, and are then put into a lime vat and by means of chains and reels handled from one lime vat to another for about eight hours. The hides are then transferred to warm water vats and treated for six or eight hours with water at a temperature of about eighty degrees, and are passed from one vat to another.

The hides are then allowed to remain in warm water of about eighty degrees for a time, say one night, after which the hair can be readily removed. After the unhairing, which may be done in the usual manner, the hides are washed in clean water and freed from lime, by the working incident to unhairing or short-hairing. Being thus freed of lime by working on the grain side and short hairing, they are worked on the flesh side, fleshed or shaved. When cleaned and shaved, the hides are put into clean cold water for a time, say over night, to swell them, although this is not absolutely necessary, and then into a coloring wheel,

with a liquor of about twenty per cent. cutch or catechu. Enough of this liquor is required to cover the hides and to produce an even color. To this liquor are next added about thirty pounds of common salt for every thirty hides under treatment, and the wheel kept in operation for about four hours to insure the hides being evenly colored. To the liquor are then mixed three pounds of alum, one pound of salt, one twenty-fourth pound of borax and one-half pound of flour (preferably rye flour) to each hide under treatment, and enough of this liquor is used to keep the hides covered; and they are left in this liquor from two to four days, being handled with the wheel for two to three hours each day. The strength of the liquor is then renewed two or three times, according to the weight of the hides, and the hides handled therein until they are sufficiently tanned. The hides are then hung up in a drying loft and when thoroughly dry, they are dampened in a vat of catechu, at a temperature of about sixty degrees, containing from twenty to thirty per cent. of catechu. The hides may now be put into a stuffing wheel for about one hour, then taken out and oiled with neatsfoot oil on the grain side, and then put back into the stuffing wheel for about an hour.

The hides are now in suitable condition for glove leather and similar uses; or they may be stuffed with a stuffing made from tallow and wood tar, composed of one hundred pounds of tallow and twenty pounds of wood tar boiled and skimmed until they unite, and kept working in the wheel until dry. They may then be worked in any suitable manner until they are well stretched out. The leather treated in this way may be finished for either belting or lacing. It may be cut up, dampened and shaved, stuffed again with tallow and tar, and also neatsfoot oil, when desired, in a stuffing wheel while still damp for about an hour, and then dried for lace leather; or it may be dampened, if too dry, in liquor, same as before, stuffed again and set out on a table and cut up and stretched for belting; or

it may be treated to make harness leather, being blackened before oiling and otherwise treated the same as for lace leather. Other kinds of leather may be finished in the usual way. Instead of stuffing the hides, they may, after being dampened with catechu to fill them with tannin, be treated with a tanning liquor to set the catechu, as in the ordinary process of tanning to make sole and similar leathers. When finished in this way, it is preferable to use a somewhat stronger liquor for filling, say one containing sixty per cent. of catechu. Of course modifications may be made in the use of this process according to the kind of hides being treated and the kind of leather desired.

Another process of tanning hides, somewhat similar to the foregoing,

Is carried out as follows: The hides are soaked, fleshed and unhaired and bated in the usual manner or in any manner desired. They are then handled two or three times a day for three or four days in a solution of alum, salt and cutch. Good results have been obtained by the use of three pounds of alum, one pound of salt, and a half pound of cutch to a sixty pound hide. These proportions may be varied. Other articles may be substituted for the said chemicals, as for instance saltpetre for salt, and japonica for cutch. After treating the hides as above, they are hung for two or three days in bark liquor formed of tan bark or bark extract and water, after which they are dried, dampened and stuffed, and finished by any well-known method of finishing leather according to the purpose for which the leather is to be used. The best way to use the bark liquor is to make it weak at first when the hides are first placed in it, say ten degrees strong, and to gradually increase the strength of the liquor until it is about thirty degrees. This process results in making a soft, pliable, well-filled leather, that may be finished in various ways. A short quick liming for three or four days in lime and sulphide of sodium prepares the hides in a very satisfactory manner for the tannage.

A composition of matter in connection with processes of tanning,
And consisting of gambier, ten pounds ; sulphuric acid, one pound ; golden seal, in powder, one-half pound ; sweet fern extract, two pounds ; water, fifteen gallons, has been made the subject of a patent. The objects of this compound are to provide a tanning solution that will act speedily and effectively in tanning and dressing hides, and one that combines economy of ingredients with superiority over other compounds by reason of its penetrating properties and beauty of finish.

In preparing the mixture used as a tanning compound, the gambier is dissolved independently in water, and then put in mixture with the other ingredients by ordinary mechanical means, the sulphuric acid being the last ingredient.

The compound having the function of dressing the hides after passing through the tanning process is composed of the following ingredients : soft water, six gallons ; sulphuric acid, one-half pound ; alum, one pound ; corn starch, one pound. The first step in the process of treating the hides or skins is to immerse the same in the tanning mixture, and letting them remain for one-half hour, then exposing them to the air for fifteen minutes. Being again returned to the mixture, they are allowed to remain for about twelve hours longer, when they are again exposed to the air for a short period of time. This work is repeated three times in the next twelve hours, then once a day for about eight days, when the hides or skins will be sufficiently tanned to be subjected to the next part of the process. This is the dressing mixture, and in this the hides or skins are allowed to remain about one hour, then washed in clean water, and hung up until they have become about half dry. Then the hides or skins are pulled and washed until thoroughly dry, when they will be sufficiently dressed, and will come out white, soft and pliable. A slight change in the dressing process is adhered to in the treatment of furs or skins with

the hair on. In such cases the skins are immersed in the dressing compound, and let remain twelve hours; are then taken out, washed in clear water, and hung up until half dry. They are then worked soft and pliable, and the fur or hair cleaned, and a fine finish is said to be obtained in this way.

This process of tanning has for its object the treating of hides and skins in such a manner as to prevent them from becoming hard,

And thus to produce leather having the qualities of softness, pliability and strength to an unusual degree. In applying the process, the hides or skins are taken, after having been cleaned of all impurities, such as blood, salt and lime, and spread out smooth. A coating of powdered crystal glauher salt is applied to the hides or skins. For a ten-pound skin as brought from a slaughter-house in its green and wet condition, one and one-half pounds of the salt will be found sufficient; while at least six pounds should be used for a hide weighing from forty to sixty pounds. About one-half of the salt is spread over the hide in the first instance, after which the hide is permitted to lie for about twelve hours, in order to have the salt absorb all the moisture, and when this time has expired the balance of the glauher salt is applied. The skins or hides are then again exposed for from twelve to twenty-four hours. The next step is to smooth the hide out upon a table and to treat the same to a composition composed of one-fourth aqua ammonia to three-fourths of oil or grease, preferably unadulterated cod-fish oil. This is coated upon both sides of the hide by means of a brush. In the case of oils and grease of poor quality, the quantity of aqua ammonia should be less than above, while in the case of richer oil and grease, the quantity should be increased. The hide is now exposed for drying purposes. After drying, the hide is placed in clean water to dissolve any sulphate of ammonia

or any of the parts of the glauber salt that may remain. The hide is then ready for the work of setting or stuffing, and after drying out again there is no staking necessary, as the leather will remain soft. The insoluble fatty compound will remain in the hide and adhere to the fibres severally, and not in a mass, leaving the fibres independent of each other, thus securing a perfect tanning, and putting the hide or skin in condition to reject water to a great extent.

Instead of pulverizing the crystals of glauber salt and applying the same in dry powdered condition, the skins or hides may be placed into a solution of common salt and sulphuric acid, commonly called the "pickle." After the skins or hides are through this pickling process, the mixture of aqua ammonia and codfish oil is applied in the manner that has been described.

This process has for its object the providing of a method of tanning leather whereby the hides are rendered soft and pliable,

Their pores are opened to permit of the thorough and effective penetration of the tanning liquor, which pores are then closed, the leather or hides are prevented from cracking, all the glue and gelatine therein being retained, consequently the leather is water-proof, and the liquor is prevented from souring, which foregoing objects are among the chief advantages of this process.

In applying this process, the first step is to place the hides in a vat containing lye and salt, in the proportion of ten pounds of the latter to one pint of the former for each hide of light weight. After soaking of the hides a specified time, as well understood by those familiar with the work, there is added from time to time a small quantity of lye, until the hair of the hides begins to loosen. Should at this stage of the procedure a deodorizer be required, about one hundred drops of carbolic acid may be added. The second step is

the liming of the hides, for which purpose, instead of lime as commonly used, lye or ashes is employed, one quart of either of which with water being added daily until the hair has become loosened. With a small amount of lye left in the hides, the latter will not crack, as has been experienced in the use of lime, in passing the hides through the tanning process proper; also in the bating of the hides, the lye that remains in the same will prevent the liquor from becoming sour, which bating of the hides is the next step. The same is carried out by adding to the liquor bran to the extent of a peck at the beginning. The final or last step consists of subjecting the hides to the tanning process, the liquor of which is made of the following ingredients, in the quantities named for a single hide: Ten pounds of salt, one pound of saccharine matter (sugar), to which is added one pound of French ochre for coloring purposes and one ounce of borax to impart softness to the hide, and water sufficient to cover the hide. The said ingredients with water, of course, are added in the same proportion for each additional hide placed in the vat.

The liquor thus produced may also be used with all astringents, and with it, and with previous treatment of the hides, the latter are possessed of the following qualities, in addition to those already mentioned: The resultant leather can be exposed to the action of water for days, and it will be perfectly impervious thereto, and the tanning is effected in a minimum space of time, while the best color is obtained for the leather.

Patented by G. W. Hersey, Empire, Wis.

The following description relates to a patented process of manufacturing and finishing leather, which is adapted for use for vamps and tops of shoes,

And may also be employed in the manufacture of other articles. The leather produced by this process possesses decided advantages as regards cheapness, durability, utility

and general appearance, and particular attention is directed to the inner or flesh side of the leather, which is colored a dull blue-black, giving it a distinctive appearance, which is so desirable, and furthermore assisting materially to lessen the cost of its manufacture.

The process used for the finishing of a calf or kangaroo skin or hide into leather adapted for the above uses is as follows: An unstuffed calf or kangaroo skin or hide, tanned by a gambier, quebracho or other vegetable tanning process, is stuffed to its proper constituency by the use of fat-liquor, and then dried in the usual manner. The inner or flesh side of the calf or kangaroo skin or hide is colored a blue-black by any desirable composition. After the flesh or inner side of the skin or hide is blue-blackened, the outer or grain side thereof is colored a jet-black by any desirable composition. After the inner and outer face of the skin or hide has been colored as desired, the same is then slicked out smooth to set out the grain on its outer or grained face. It is then dried in the usual manner. The skin or hide is then staked and trimmed in the ordinary way.

The skin or hide is then seasoned by the use of blue-stone, iron, logwood, ammonia, blood and nigrosine, the proportions being as follows: Blue-stone, one-half pint; iron, one-eighth ounce; logwood, one-half pint; blood, one pint; nigrosine, one-half pint. The skin or hide after it has been seasoned, is then dried at a temperature of 120° to 180° Fah. After it is dried it is glazed in any desirable manner.

The skin or hide after it has passed through the glazing process is again staked. After it has been staked it is seasoned again by the use of blue-stone, iron, logwood, ammonia, blood and nigrosine in quantities and proportions the same as in the first instance. After the seasoning the skin or hide is dried at a temperature of 120° to 180° Fah., and is then glazed in any desirable manner.

After the glazing process is finished, the hide or skin is

again staked, seasoned again by the use of blue-stone, one-half pint ; iron, one-eighth ounce ; logwood, one-half pint ; blood, one pint ; nigrosine, one-half pint. The hide or skin is then dried again and glazed, and is then ready for the market.

The leather produced by the foregoing process has an unusually high-polished, grained surface, and possesses all the qualities of the ordinary leathers now on the market. It has the appearance of patent or enameled leather to a great extent, as well as glazed kids and other glazed leathers. At the same time, when in use the leather will be free from excessive cracking or breaking, which is usual in patent and enameled leathers. A patent has been taken out on the above process by Messrs. C. E. and H. A. Lappe, of Pittsburg, Pa.

Rapid process of drum tanning.

In the tanning of hides as generally conducted, the necessity of allowing the hides to remain for long periods of time in the tan pit has, when operations are conducted upon a large scale, involved the investment of a great amount of money, in that a large plant has been required to afford the space necessary for the number of pits it has been essential to use, and in that during the many months elapsing between the purchase of the hides and the completion of the tanning operation, the capital invested in the hides is practically idle. In the following-described process, patented by Jacques Durio, of Turin, Italy, the time of converting raw hides into tanned leather is greatly shortened.

The hides to be tanned are first unhaired and fleshed in any usual manner. Immediately after the completion of the unhairing and fleshing operations, the hides are placed in a bath of hydrate of soda, or soda ash, consisting of water four times the weight of the hides, and of the hydrate one to four per cent. of the weight of the hides, and the hides

are allowed to remain in this bath for from three to six hours. The hides are given this hydrate of soda bath for the double purpose of removing as much as possible of the lime which has adhered to them, and at the same time of dissolving out from them as much as possible of the fatty matters naturally in or adhering to the same. The hides are then washed by an energetic fulling or drumming operation with pure water, in the same vessel if desired, the result of which is that by the action of the water and by the manipulation of the hides the latter are caused to expel from their pores a large proportion of the lime and the fatty and other foreign matters. After the fulling or drumming operation, the work of removing the lime, fatty matters and hydrate of soda, or other foreign matters or impurities, is continued by subjecting said hides to a very careful purging or scudding. After allowing the hides to remain in a bath of water for about twelve hours, they may be placed in piles and allowed to drain for ten hours. Then, to free the hides from grease, they are subjected to the action of benzine, turpentine or other solvent, preferably by placing the hides in a drum with the solvent and rotating the drum to effect a fulling action upon the hides. This operation lasts about two hours. The solvent, being of extreme fluidity, rapidly permeates the interior of the hides, and displaces, forces or draws out by physical or chemical action, a further amount of grease or other impure substances, which float, so to speak, on the surface of the hides and form a deposit in the nature of a coating thereon. After the formation of this deposit or coating, and while the drum is still rotating, the final step of the preparatory stage of the process is performed, which consists in the addition to the mass within the drum of a quantity from one-tenth to one-fifth of the weight of the hides, of pure tannic acid, the drumming or rotation of the drum being continued for a period of time ranging from one-half hour to one hour. The tannic acid introduced to the mass

within the drum effects an incipient or preparatory tanning of the hides.

By the last operation the impurities are separated from the hides, and then removed from the drum, the hides being left free from grease, lime and foreign matters, with their pores well dilated, and the texture and fibre of the hide well prepared for the final tanning stage of the process.

The hides are left in the drum, and there is introduced to them a quantity of pure tannic extract proportionate to the area of the drum and the quantity of hides contained therein, and the drum is rotated and the hides subjected to a fulling operation, this operation being continued until the hides are completely tanned, the time ranging from two to eighteen hours, according to the thickness of the hides.

Instead of subjecting the hides to a preferred preparatory treatment with tannic extract and then to a final treatment with the extract, as has been described, the process may be performed by treating the hides with tannic extract introduced thereto at intervals, from time to time, or it may be performed by subjecting the hides to tannic extract applied in one operation. The results generally obtained, however, by the last-named mode of operation are less satisfactory than the results obtained by the others. When the hides are removed from the drum, they will be found, notwithstanding the brevity of their exposure to the tanning extract, thoroughly and uniformly tanned, and the product, even in the case of the heaviest hides, will be of fine, salable and durable quality of leather.

In the ordinary tanning operations it is customary to employ a tanning material known as tannic solution or liquor, made by adding water to commercially pure tannic extract. By this rapid process of tanning, the results of the process are obtained by the use of tannic extract in contra-distinction to tannic solutions. By the term "tannic

extract" is meant the well known article of commerce, the same being an infusion or leach of a suitable vegetable substance such as chestnut wood, oak bark, etc., concentrated by evaporation.

The addition of water to tannic extract results in the chemical or physical disintegration of the extract and the precipitation of certain constituent elements thereof, so that the decreased fluidity of the extract and the diminished active tannin or other astringent tanning principle thereof, render it a much less effective tanning agent than the tannic extract from which it has been made. The inventor of this process claims that in the process of tanning by the use of tannic solutions there is a loss, which is due on the one hand to the precipitation by the addition of water to the tanning extract of substances which by precipitation become inert and inactive in the tanning operation, and on the other hand to a decreased weight in leather by reason of the diminished quantity of astringent or tannic principle remaining in the solution as compared to that contained in the original extract from which it was prepared. The advantages, therefore, that he claims are incident to the use of tannic extract as opposed to tannic solutions, are a decrease in the time necessary for the tanning operation; an improvement in the quality of the leather produced; a material saving in the quantity of tanning extract or agent necessary to be employed, and an increased weight of leather produced. Another advantage claimed for the use of the tannic extract as opposed to the use of tannic solution is that in the tanning operation with the use of solutions it is usually necessary to throw away and lose a great portion of the tannic solution remaining at the end of the tanning operation, not only because of the fact that it contains precipitates and impurities incident to the admixture of water with extract to form the solution, but also because the water in said solution, and the impurities contained in it, occasion the further deterioration of the solution, so as

to render it unfit for use in a tanning operation subsequent to the first few operations in which it is employed. In the use of tannic extract in this process, the extract remaining at the end of a tanning operation is sufficiently clean, pure and strong to be well suited for use in subsequent tanning operations, from which it results that the tannic extract at the end of the tanning operation need not be thrown away and become waste material, but may be further repeatedly utilized, and thus offers a large saving of expense.

Another rapid process of drum tanning

is the invention of S. and G. Durio, of Turin, Italy, and has for its object the provision of means whereby the time required in tanning hides is not only reduced, and a final product of superior quality obtained, but the operation of tanning is simplified and the labor and expense connected with the same materially reduced. In this process abnormally strong solutions of tannin or tannic extract are employed, and the leather prevented from becoming case-hardened, burned or otherwise injured by being kept in more or less violent motion. By this process the largest and heaviest hides can be tanned in about thirty hours, hides of less size and weight can be tanned in about twenty hours, while such skins as sheep, lamb, and goatskins, can be tanned in about four hours. By the term abnormally strong tannin or tannic acid solutions is meant solutions of a strength not less than $6\frac{1}{2}$ degrees Beaumé, equal to $48\frac{3}{4}$ degrees barkometer, although it is preferable to use a solution of a strength of from about 8 degrees Bé., equal to 60 degrees barkometer, to 20 degrees Bé., equal to 150 degrees barkometer, the strength of the solution being kept uniform during the entire process by the addition of tannin or tannic acid. In carrying out this process, a solution of tannin or tannic acid of the strength above referred to is prepared and poured into any suitable vessel to which motion may be imparted, as, for instance, a pin-mill drum,

after which the hides are introduced, and the drum is set in motion, and the motion is continued until the hides are tanned, except for such brief periods as are necessary to test the strength of the solution and reconstitute the same to its original strength, or to a strength slightly above its original strength. If the hides are large and heavy, the strength of the solution may vary from 8 degrees Beaumé, equal to 60 degrees barkometer, to 20 degrees Bé., equal to 150 degrees barkometer, the quantity of solution being sufficient to nearly half fill the vessel before the hides are put in. During the milling of the hides in the drum, the liquor is tested from time to time and reconstituted to its original strength, or slightly above its original strength, so that when the operation of tanning is completed, which for large and heavy hides does not exceed thirty hours, the liquor in the drum will be of the strength required for a fresh lot of hides. For small skins, such as sheep, goat, and the like, the strength of the liquor may be reduced to about $6\frac{1}{2}$ degrees Beaumé, equal to $48\frac{3}{4}$ degrees barkometer if desired, but it is preferable to use liquor of about 8 degrees Beaumé, equal to 60 degrees barkometer, though this may be increased to 20 degrees Beaumé, equal to 150 degrees barkometer, without the least injury to the stock, the time required for tanning being from two to four hours. For hides of medium weight, the time required is about twenty hours or less, according to the weight of the hides, the strength of the liquor being as above stated, or from 8 degrees to 20 degrees Beaumé. In this process of tanning the hides do not undergo any special preparation, except depilation, swelling or raising, removal of flesh and fat, and washing, *i. e.*, the usual preparations necessary to place the hides in proper condition to be acted upon by the tannic acid. Neither grease, dubbing, nor chemicals of any kind are employed either before or during the process of tanning. For the purpose of tanning, any suitable tannic acid may be used, preferably as pure a tannic acid

as can be obtained. The hides are introduced into the drum, and not again handled until the operation of tanning is completed, after which the leather is treated in the usual manner.

If it is desired, the hides may at the start be subjected to the action of a weak liquor, as, for instance, a liquor of about 3 degrees to 4 degrees Beaumé, the strength or density of the liquor being gradually increased to from 8 degrees to 20 degrees Beaumé. There is, however, no special advantage in doing this, and although the results are the same, yet the time required for tanning a lot of hides or skins is increased, and for this reason it is preferable to start the operation with what is considered an abnormally strong solution, the strength of which is uniformly maintained from the beginning to the end of the operation, so as to leave the liquor in a condition for use with a fresh lot of hides. After the liquor has been used for about six times it should be filtered to remove foreign matter therefrom.

Any suitable apparatus may be employed, yet such apparatus should be provided with special devices for facilitating the strengthening up of the tanning liquor from time to time, and particularly for discharging the gases evolved during the operation of tanning. The time of tanning is shortened from days to a few hours.

In the practical application of the original Schultz two-bath process,

The skins are tanned in the following manner: The first bath consists of four pounds of bichromate of potash and two pounds of muriatic acid in sufficient water to enable the skins to process nicely. The quantities of bichromate of potash and acid mentioned are for every one hundred pounds of skins, weighed as they come from the preparatory processes. The bichromate of potash is first dissolved in hot water, and then the muriatic acid is added. This first

bath may be applied to the skins in a drum or in a vat. When a drum is used, from ten to fifteen gallons of water are required for every hundred pounds of skins, and the skins drummed in the yellow chrome liquor until they are thoroughly impregnated with it, when the first bath is completed. When a paddle vat is used, enough water is required to cover the skins, so that they are allowed to float and turn in the liquor by the action of the paddles. Both methods are used. The drum method is, however, usually preferred, as the results are accomplished in shorter time than when vats are used. It is highly important that the skins are thoroughly impregnated with the chrome liquor, in order that they may be completely tanned in the second bath. The length of time consumed by the first bath depends upon the thickness of the skins. Very light sheep and goat-skins require only a short time, sometimes less than an hour, while heavier skins need longer time.

When the skins are removed from the liquor, the strength is not usually exhausted, and the liquor may be used for another lot of skins by strengthening it up with bichromate of potash and acid. When bichromate of potash is acted upon by muriatic acid, there result chromic acid and chloride of potash. The latter does not assist at all the tanning, neither does it do any harm. While the skins are saturated with chromic acid, they are in a very sensitive condition, and require careful and intelligent handling. They should not be exposed to the air or strong sunlight, but kept protected until they are placed in the second bath. The practical object of soaking or drumming the skins in the chromic acid liquor is to have the chromic acid in the skins when they go into the second bath, in which the actual tanning takes place. After the first bath is completed and the skins are removed from the liquor, they should be left in piles for a few hours, in order that the surplus liquor may drain off, or they may be pressed or struck out, and are then ready for the second bath.

The original formula for this part of the process was ten pounds of hyposulphite of soda and two and one-half pounds of muriatic acid for every one hundred pounds of skins. The hyposulphite of soda is dissolved in hot water and then the muriatic acid is poured in and the solution is well stirred, and then incorporated in the required quantity of water. This part of the process is usually done in paddle vats. The skins are left in the liquor until the yellow color has entirely disappeared and the skins have assumed a pale bluish color through the thickest part of the heaviest skin, which is perceived by cutting. By the time this has been accomplished the skins are tanned and may then be removed from the liquor and washed thoroughly and then finished. For the second bath it is good practice to make up a liquor by using only half of the quantities named, and after the sulphur smell has become faint and the skins seem to have absorbed all the sulphurous acid, to add the other half of the materials used and leaving the skins in until they are entirely leathered. Good results are also obtained by dipping the skins as they come from the press or the striking machine after the first bath in a weak solution of hyposulphite of soda and acid. By this method the skins are not subjected to the strong solution at the start, which sometimes causes a rough grain and closes the pores of the skins, which are especially undesirable on grain-finished leather.

The quantities of hyposulphite of soda and muriatic acid required by a lot of skins depend somewhat upon their condition when they go into the second bath. Usually it requires two and one-half times as much hyposulphite of soda as of bichromate of potash used. The work of the second liquor can be accomplished in a few hours, although the best results are obtained when the skins are left in the liquor over night. They may go into the liquor, say at four o'clock, and be paddled until six o'clock, and after lying in the liquor over night, may be paddled a short time in

the morning, and will then be thoroughly tanned. It is never productive of the best results to hurry the skins. The longer time they are given in both the first and the second bath, the better will be the final result.

The muriatic acid acting upon the hyposulphite of soda causes the formation of sulphurous acid, sulphur, and chloride of sodium. The sulphurous acid thus formed is the active agent of the bath, and by its action upon the chromic acid of the first bath with which the skins are impregnated, causes the formation of chromic oxide throughout the skins, and this results in leather. Skins can also be tanned by reversing the usual order, and first soaking the skins in the liquor of hyposulphite of soda and acid, and then applying to them the chrome liquor. The time consumed is considerably shortened when the liquors are used at a temperature of about ninety degrees. For chemical reasons it is necessary when tanning with this process to use enough muriatic acid in the first bath to liberate all the chromic oxide. In consequence of this, and because the tanner does not always understand the process and fails to properly adjust the proportions, there is an excess of muriatic acid used which remains as such in the liquor not in combination with the bichromate of potash. This results in injury to the leather. Chromic acid is frequently used by tanners in the first bath. When it is used, no muriatic acid is required; only so much chromic acid is used as the tanner would use of bichromate of potash; *i. e.*, if a tanner would use four pounds of potash and two pounds of acid he would require to accomplish the same results four pounds of chromic acid and no muriatic acid at all.

The inventor of the process that has just been described is also the discoverer of the following process,

Upon which he has been granted a patent: For each hundred pounds of skins as they come from the beam-house, drained after the final washing, four pounds of bichromate

of potash and three pounds of muriatic acid of a strength of 20 degrees Be. are mingled with the quantity of water necessary to drum the skins in. In this liquor the skins are drummed until they are thoroughly impregnated with the liquor; then they are removed from the drum, drained or pressed or struck out, and are then ready for the second bath. One hundred gallons of water are heated to a temperature of about ninety degrees. Into this are poured five pounds and five ounces of sulphuric acid of a strength of 66 degrees B \acute{e} . This is well mixed through the water, and then are added, by being slowly sifted in, four pounds of peroxide of sodium. While this is being done, the liquor should be constantly stirred. When all the peroxides of sodium have been added, the previously-chromed skins are entered into the liquor and paddled until they are tanned, which can be readily seen by the tanner. In this process no sulphurous acid is evolved. The grain of the skins is left smooth and readily adapted to receive a glazed or enameled finish.

Skins to be tanned according to the Zahn process

Are taken after the final washing or drenching and treated to a bath composed of, for every one hundred pounds of skins, five pounds of bichromate of potash, two pounds of salt and two and one-half pounds of muriatic acid. This may be applied to the skins in a drum or in a paddle-vat. When a drum is used, the volume of liquor should be about ten gallons, while in a vat it is, of course, much more, the dissolved chrome and acids being mingled with at least fifty gallons of water. The skins are exposed to the action of this solution for a sufficient length of time to enable them to become thoroughly impregnated with it, after which they should be allowed to remain in the liquor for a number of hours and then drained and pressed for some hours. They are then transferred to the second bath, which consists, for every hundred pounds of skins, of eight

pounds of hyposulphite of soda and one and one-half pounds of sulphuric acid of a strength of sixty-six degrees Baumé, dissolved in ten gallons of water. This solution is mixed with sufficient water in a tub or vat, and the skins placed therein and stirred about for thirty minutes. After an intermission of half an hour they are again stirred about for thirty minutes, and then allowed to remain in the liquor with occasional stirring for ten or twelve hours, according to their thickness. From this bath they are washed and then placed in the third bath, by which the leather is made strong and supple and softness imparted to it. This third bath is composed of a mixture of saponified neatsfoot oil and two ounces of caustic soda, which are dissolved in one gallon of water and heated by steam until the oil is thoroughly saponified. Then an extract of five pounds of quercitron bark, or any other solution containing tannic acid may be used. This last liquor is given to the skins in a pin-mill drum, and the skins drummed in the solution for about thirty minutes, then they are removed and dried in the usual manner.

If the leather is to be colored fancy shades,

The dyeing may be done while the stock is in the drum, it being finally washed off and allowed to dry. For black, the leather should be removed from the drum and dyed either on tables or in trays or boxes. After coloring or blacking, a light coat of oil is applied to the grain of the leather, which is afterwards dried in a warm room, staked or worked soft, glazed or ironed in the usual way. For preparing the skins for this process of tanning, and to get soft, smooth-grained leather, the skins are prepared in a solution of sodium for three or four days, after which they may be limed for a day or two, then bated in the process usually employed, washed, and are then ready for tanning. The difference between this process in which three baths are used, and the regular two-bath chrome process, is that

in the latter case the first bath consists of four pounds of bichromate of potash and two pounds of muriatic acid for every one hundred pounds of skins, while in this process the first bath is composed of five pounds of bichromate of potash, two pounds of salt, and two and one-half pounds of muriatic acid. For the second bath the Schultz process calls for ten pounds of hyposoda and two and one-half pounds of muriatic acid, while in the Zahn process eight pounds of hyposoda and one and one-half pounds of sulphuric acid are used. Then the skins are given the last bath, which in the Schultz process is not used at all.

The following description relates to an improved process of chrome tanning,

By which some economy and other advantages are obtained. The beam-house work for this process is the same as for any other process of chrome tanning. The tanning is also practically the same, with the exception that in this process a continuous evolution of nascent hydrogen is provided for in the second or reducing bath. The nascent hydrogen operates to change the sulphurous acid present in the second bath into hyposulphurous acid, which is a very powerful reducing agent, and also possessed of other advantages that will be mentioned and described later on. In this process of chrome tanning the hides or skins are first subjected, in the usual manner, to bichromate of potash or of soda, dissolved in water to which an acid, such as hydrochloric acid, is added. The first bath of the process is usually made up, for each one hundred pounds of skins, of about five pounds of bichromate of potash or of soda, and two and one-half pounds of hydrochloric acid of 21 degrees Bé., or an equivalent amount of sulphuric acid, the quantity of water used being sufficient to properly cover the skins. The hides or skins are treated to this liquor until they are thoroughly impregnated with the chrome compound, and are then removed, pressed or struck out, to

remove surplus liquor, and are ready for the second or reducing bath.

The difference between this process of tanning and the regular chrome process, is in the manner of reducing the chromic acid in the skins to chromic oxide in the second bath. This second bath usually consists of hyposulphite of soda, muriatic acid and water. The action of the acid upon the hyposulphite of soda is to cause the generation of sulphurous acid and sulphur. The active agent in this bath is the sulphurous acid which quickly penetrates the hides or skins, while sulphur is also deposited in the fibres of the grain and flesh sides of the skins. The sulphurous acid is very corrosive, and together with the sulphur clings most tenaciously to the leather, so that after the tanning is completed the leather requires a very thorough washing to rid it of these objectionable materials, which, left in the stock, cause serious damage to it. The use of the ordinary reducing bath of sulphurous acid has therefore some very unpleasant features. It is the object of this improvement to overcome the unpleasant features by causing a continuous liberation of nascent hydrogen in the bath, the effects of which are to convert the sulphurous acid into hyposulphurous acid. This result is accomplished by the employment of metallic zinc in the bath. This is very simply and economically achieved by placing a number of pieces of zinc in the paddle or reel containing the bath, these pieces being sufficiently large and heavy to remain at the bottom of the reel. The action of the acid bath is to liberate nascent hydrogen from the metallic zinc. Other methods of accomplishing the objects of this process may be employed.

For the treatment of one thousand pounds of skins, the inventor recommends a bath of one hundred and twenty-five pounds of hyposulphite of soda and fifty pounds of muriatic acid in six hundred and fifty gallons of water, and to this bath are added sixty pounds of metallic zinc.

The zinc should be allowed to remain when the liquor is drawn off after the bath is exhausted and a new bath is prepared, and about five pounds of zinc should be added once a week. Instead of pieces of zinc being used in the liquor, the vat or reel may be lined with sheet zinc and thus a large surface be exposed to the action of the acid liquor. In place of hyposulphite of soda and acid, a solution of bisulphite of soda is sometimes used to accomplish the work of the second bath. When this material is used, no muriatic acid is required, as the bisulphite of soda is charged with sulphurous acid gas. The quantity of this material used may be the same as of hyposulphite of soda, and the metallic zinc may be used in a bath prepared in this way in the same manner as has been described. No sulphur is evolved in such a solution, but the nascent hydrogen is none the less an advantage, as it lessens the quantity of bisulphite of soda that is required by changing the sulphurous acid into hyposulphurous acid. It is customary, after the skins are taken from the first chrome bath and pressed or struck out, to dip each one singly into a dilute solution of hyposulphite of soda and muriatic acid, this treatment being for the purpose of accomplishing a slight surface reduction, and thus bringing the stock into the best condition for the reducing bath. A vessel lined with zinc may be advantageously used to contain the liquor into which the skins are dipped, or pieces of zinc may be added to the solution, as the nascent hydrogen which will thus be developed will increase the efficacy of the solution. Less hyposulphite of soda will be required and less sulphur will be developed.

The advantages of this method of tanning are that a comparatively small amount of sulphur is liberated, and little or no sulphurous acid brought into contact with the skins or hides, so that when the latter are taken from the reducing bath, very little washing is necessary to perfectly cleanse them and make them quite neutral and in good

condition for the subsequent finishing operations, and in this way material economies of time, labor and apparatus are gained. By this method of evolving hyposulphurous acid in the bath, which is a more powerful reducing agent than sulphurous acid, less hyposulphite of soda is required than in the regular acid process. The quantity of hyposulphite of soda used may be reduced one-half, that is to say, where twenty per cent. of the weight of the skins of hyposulphite of soda have been used, and five per cent. of muriatic acid, ten per cent. of hyposulphite of soda and five per cent. of muriatic acid will suffice in this method of tanning. On a large scale this means a considerable saving.

Patented by W. M. Norris, Princeton, N. J.

Reducing with Hydrogen Dioxide.

When skins are saturated with a chromate such as bichromate of potash and an acid such as muriatic acid, and then submitted to the action of a reducing agent sufficiently strong and rapid in its action, chromic oxide is separated out through the body of the skins, and leather results. This is the principle of the two-bath chrome process. To accomplish the reduction of the chromic acid with which skins are impregnated when they come from the first bath, a number of agents have been proposed and used.

In the foregoing processes, hyposulphite of soda in the presence of muriatic or sulphuric acid has been the reducing agent. Other reducing agents that have been proposed are hydrogen sulphide, either as gas or evolved from a metallic sulphide in conjunction with an acid, such as ferrous sulphate, cuprous sulphate or chloride, oxalic acid of greater or less activity. A two-bath process in which the skins are saturated with bichromate of potash and muriatic acid, and the chromic oxide in them reduced to chromic oxide by the use of hydrogen dioxide, is carried out in the

following manner. The hides or skins are prepared for tanning in the usual way, that is, they are limed, unhaired, bated and washed, or pickled skins may be tanned in the pickled state. The first part of this process, as with all two-bath processes, consists of a liquor composed of bichromate of potash and muriatic acid in the proportions of five pounds of the former, and two and one-half pounds of muriatic acid of 21 degrees Bé. for each hundred pounds of hides or skins. This is applied to the hides or skins in a drum and the drumming continued until the yellow liquor has penetrated every fibre of the thickest skin. The second part of the process consists of a dilute solution of hydrogen dioxide. In this bath the color of the skins is changed as the reduction proceeds, from yellow to greenish-blue, something of a slate color. For this method of reducing the chromic acid to chromic oxide, the claims are made that there is nothing foreign or injurious added to the stock during tanning to seriously affect the finished product.

This is an important advantage over all other reducing agents. There is no separated sulphur that requires prolonged washing out, as with the use of hyposulphite of soda and acid; no sulphuric acid is formed by the oxidation of the reducing agent, and no oxides of iron or copper formed to affect the character of the leather. In this process the reduction is very rapid, much more so than when other agents are used, and the bichromate is changed in the hides before it can bleed or diffuse out as sometimes takes place with reducing agents of slow power. It is not necessary to have the hydrogen dioxide ready prepared in solution, but the same results are obtained by the use of such peroxides as will produce hydrogen dioxide with dilute acids, as barium peroxide, sodium peroxide, and others of similar properties. The bath of hydrogen dioxide is kept slightly acid with muriatic or sulphuric acid, and the hydrogen dioxide or metallic peroxide for its generation is added in small successive portions, so the mutual decomposing action

with the chromic acid in the skins goes on steadily, but without loss of oxygen from the decomposition of the dioxide in the bath. During this part of the process the hides or skins should be kept in motion so that not only will they be uniformly exposed to the liquor, but will be freed from the oxygen gas which escapes from the surface of the hides or skins in minute bubbles. A point of importance to be noticed in connection with the second bath is that no metallic surfaces be exposed to the action of the solution. Vats made only of wood should be used, as otherwise considerable hydrogen dioxide will be decomposed and lost without doing its work upon the skins. At first the yellow chromed skins turn a decided blue color in the reduction bath, but this does not affect the result, as it soon disappears when the green color of the reduction shows itself. The color gradually changes from yellow to greenish-blue, as is the case in all chrome processes of tanning.

The reducing bath for this method of tanning may be prepared with sodium peroxide instead of hydrogen dioxide, as has been already suggested. In practice this is accomplished by heating one hundred gallons of water to a temperature of ninety degrees. This water is acidified by the addition of five pounds and five ounces of sulphuric acid of a strength of 66 degrees Beaumé. The acid should be well stirred throughout the water, and then are added by being slowly sifted in four pounds of sodium peroxide, the liquor being constantly stirred. When all the sodium peroxide has been added, the bichromated skins, after draining or pressing, are entered into the liquor and stirred about until the reduction of the chromic acid is complete and the skins are tanned, which can be readily seen by the tanner. The skins may be paddled for an hour or two, then left still in the liquor over night and paddled again for a short time the next morning. The process may also be completed in less time than this, according to the necessity of hurry and thickness of the skins. Before

coloring and drying out the leather, it should be very thoroughly washed.

Patented by Samuel P. Sadtler, Philadelphia.

Among the various processes used to accomplish the changing of the chromic acid in skins into chromic oxide

Is one by which the work is accomplished by the use of sulphate of iron in combination with acetic acid. In carrying out this process, the skins are prepared for tanning in the usual manner, and are then immersed or treated in a drum with a solution of chromic acid. This may be composed of bichromate of potash and muriatic acid in the regular way, or of chromic acid in powder form dissolved in water without the muriatic acid. Some acetic acid is added to the liquor. This liquor is composed of the usual proportions, and the skins are saturated with it until they are thoroughly impregnated with it, the length of time depending upon the thickness of the skins. When the chrome liquor has thoroughly penetrated the skins they are pressed or are drained until they are freed of the surplus liquor. Then they are ready for the reducing bath. This is a solution of sulphate of iron, in proportion of one part iron to nine parts of water, in which the skins must remain until the tannage is complete. After this the skins are washed and dried in the usual manner. With either or both of the solutions is combined acetic acid in the proportions of one part of acid to sixteen parts of solution. In place of acetic acid, any chemical equivalent may be employed. Instead of pure acetic acid, either vinegar or pyroligneous acid may be used. The proportions of ingredients used in this method of tanning may be changed; the order of solutions may also be reversed. In place of chromic acid or bichromate of potash in the first bath, other chrome salts may be used, as for example, bichromate of soda, also bichromate of ammonia. While the sulphate of iron is considered the best article to use in the second bath, other iron salts may be substituted.

The acetic acid used may be in the pure form, or as contained in vinegar or pyroligneous acid. The use of the acetic acid is very essential in getting a thoroughly and uniformly tanned leather. The acid may be used in connection with either of the alternative baths. When it is not used, and the skins are immersed simply in the chromic acid bath and then in the sulphate of iron liquor, to which no acetic acid has been added, the iron salts do not penetrate properly, and the result is a crusty deposit on the skins, and the grain is brittle and hard and the interior of the skins is hard, owing to its being improperly tanned. When acetic acid is used, the penetration of both the chromic and iron salts is uniform throughout the skins, the leather is thoroughly tanned and finished up soft, tough and with a fine smooth grain. Pickled skins, such as pickled sheep, lamb and goat-skins, also pickled hides may be tanned in this process in the pickled condition, no drenching being necessary, simply a drumming or soaking in salt water to soften and open them out.

Patented by S. Chadwick, Philadelphia, Pa.

This method of tawing, is a process for the making of chrome leather,

And consists of subjecting the hides or skins to a liquor containing a chrome salt, and then treating the same with a solution containing a cuprous salt. One hundred pounds of hides or skins are prepared for the process in the usual way. Then they are immersed in a solution of five pounds of bichromate of potash and two pounds of salt, which are dissolved in five gallons of water, to which two and a-half pounds of hydrochloric acid are added. The hides or skins remain in this solution until they are thoroughly penetrated with the liquor, which usually takes from three to five hours, but in the case of thin skins less than three hours are required. Either drums or paddle vats may be used, the same as for any process of chrome tanning. The sur-

plus liquor is then removed by pressure or by striking out on a machine. The second bath of this process differs from all other two-bath processes by reason of its being made up of sulphate of copper, salt and alum. For every two hundred pounds of hides or skins to be treated, five and one-half pounds of sulphate of copper, thirty pounds of common salt, and six pounds of alum, dissolved in twenty-five gallons of water are used. This solution is run into a closed vat containing copper cuttings, and is left to stand upon them until the solution has become almost colorless, which indicates that the cupric salt is reduced to cuprous salt, which is kept in solution by the presence of the common salt. This solution is now ready for use, and the hides or skins are immersed therein. As soon as they are immersed in this solution their previous yellow color is rapidly changed into a greenish-blue color, as the hides or skins contain chrome as well as copper, after which they are ready for further treatment.

In preparing the copper solution, cupric chloride may be used in place of cupric sulphate; also in place of common salt, any other neutral substance which is known to be a solvent of cuprous chloride may be used. The solution once used may be reinforced from time to time by the addition of such substances as have disappeared from it partly or wholly by being taken up by the skins. The solution may, after being treated with metal copper, be again used for another quantity of hides or skins. The solution that cannot be used any more, can be freed from copper by running it into tanks containing scrap-iron, on which the copper is precipitated.

In place of treating the skins first with a chrome solution, the copper solution can be first applied to the skins prepared for the process, after which they may be treated with the acidified bichromate of potash solution.

Patented by H. Endemann, Brooklyn, N. Y.

ONE-BATH PROCESSES OF CHROME TANNING.

Owing to the many unpleasant features of two-bath tanning, and the difficulties and perplexities and failures met with by inexperienced tanners in using the two-bath liquors, without sufficient knowledge or experience, the one-bath processes of chrome tanning have become very popular. They deserve their popularity, by reason of the simplicity and ease with which leather can be made. There are several one-bath processes that have been introduced, all possessing some merit. The tanning material is sold to the tanner in concentrated form, all ready for use. In a general way these liquors are used in much the same manner as sumac, bark and gambier liquors are used. When they are used in paddle vats the skins are entered into a weak liquor at the start, and as they absorb the tanning material contained in the liquor, the strength of the bath is increased until it becomes a fairly strong solution. Any tanner who has had experience with two-bath processes finds the one-bath method exceedingly simple, while any tanner not familiar with chrome tanning, but experienced in bark or sumac tanning, ought to be able to readily understand the new process and to meet with little difficulty in making chrome leather by a one-bath process. While a great deal of the quality of the finished leather depends upon how the skins are tanned, much more depends upon how the skins are prepared for tanning, and how they are treated after they are tanned, during the processes of currying and finishing. One-bath liquors do not change character with age, and are not injured by frost nor exposure. They are clean and free from smell and stain, and can be regulated by the tanner to tan slowly or quickly as he may desire. When they are used in vats, the liquors can be used over and over for successive lots of skins, by being strengthened up, and great economy can thus be attained. In two-bath processes the skins are subjected to the action

of corrosive materials which often produce damage to the leather.

This is all avoided when one-bath liquors are used, as they are neutral, or nearly so, and free from uncombined acids. The results that follow their use can be easily regulated, and are as a usual thing very uniform and reliable. The mere tanning with these concentrated liquors is a very simple and straightforward process, and little experience is required by the tanner, provided the skins or hides have been properly prepared in the beam-house. Thorough liming and bating or drenching is necessary in order that the skins may be soft and pliable to begin with. As chrome leather is usually finished upon the grain, the skins require to be handled in such a manner that the grain is left smooth and strong, and not allowed to become rough, coarse or weak. In order that the skins may be thoroughly tanned, and no thin strip of raw material left through the center, which would cause the leather to be hard and tinny when dried out, the tanner must use plenty of the tanning material. No harm can come to the skins when they are left in the liquor for a long time, as it is absolutely necessary that they are thoroughly tanned, which can not be depended upon when they are rushed through the process in the shortest possible time. Some of the one-bath tannages are more astringent than others, and their effect upon the skins is to draw or contract the fibres. When this is liable to occur, common salt should be added to the liquor in the same manner and for the same reason that it is used in conjunction with bark, sumac or gambier liquors,—to hasten the tanning, to keep the skins open and plump, and to prevent the contraction of the fibres. One-bath liquors are used successfully in drums, paddle vats or vats with rockers. They are applicable to hides and skins of all kinds, and for making every kind of leather from kid-glove leather to sole leather. The two-bath processes are sometimes preferred to the one-bath processes in the tanning of

goatskins for glazed kid, as they seem to split up the fibres and to produce a finer grain than the single-bath liquors. Yet very good kid leather is made with one-bath processes, with one point in their favor, that the leather so made is plumper than that produced by acid processes, which have no plumping nor filling properties whatever, but leave the skins thin and without plumpness.

Tanolin (The Martin Dennis Process.)

The best known of all one-bath chrome processes is the Dennis process, called Tanolin. This material is manufactured under patents and sold to tanners outright in barrels, no licenses being required, and no royalties asked for. The use of Tanolin is very general among tanners. It is especially adapted to the making of soft, tough leather used in the manufacture of shoes and gloves. Its field of usefulness is not, however, restricted to these branches of the leather trade, but extends to heavy leather for harness, belts, and for any purpose where tough supple leather is required. It must prove interesting to practical tanners to know how this popular tanning material is prepared. The manufacture of the liquor is covered by patents. According to the patent specifications, a solution of common chloride of chromium is first prepared. This may be done by dissolving the pigment known as chrome green, or the commercial chrome oxide, in commercial hydrochloric acid which has been diluted with an equal bulk of water, care being taken to use more chromic oxide than the acid will take up, in order that the resulting liquor may be as nearly neutral as possible. About eight ounces of the commercial acid are sufficient to dissolve a pound of commercial oxide of chromium. To this solution of chloride of chromium is next added slowly and carefully a solution of a more powerful base, and for this purpose carbonate of sodium, or as it is commonly called, sal soda, is preferred. This is added until rapid effervescence ceases. It usually takes about one-half

pound of sal soda crystals to each pound of chrome oxide, dissolved as above. The liquor which results is a solution of basic chloride of chromium. It may be considered as consisting of the normal chloride of chromium and chromic oxide in soluble combination, and a quantity of chloride of sodium or salt formed by the union of a part of the acid, which was in combination with the chromium, with the sodium base of the carbonate of sodium. This sodium chloride in the liquor serves the very useful purpose of preventing the drawing or contracting of the fibres of the hides or skins that would result were it not present in the solution. To the solution are also added a few pounds of common salt to still further counteract the astringent effects of the chrome liquor. In the two-bath processes of tanning, the chromic acid is presented to the skins in the liquor of the first bath, which usually consists of a solution of bichromate of potash and muriatic acid. The chromic acid in the skins is reduced to chromic oxide by the action of some reducing agent, such as sulphurous acid or sulphuretted hydrogen. Chromic acid is a very powerful oxidizing agent and does more or less injury to the hides or skins. It requires great care and caution to produce with these methods of tanning, leather that does not crack or break nor become hard and brittle after it is dried out. The principle of the Dennis process is to impregnate the hides or skins with the liquor in which the chromic oxide is held as an already reduced salt and not in combination with acids. In practice, the prepared hides or skins are treated to the tanning liquor in drums or paddle-vats; and it is necessary that during the process they be frequently moved about in order that the action of the chromic salt may be uniformly distributed. The length of time consumed in making leather by this process varies according to the thickness of the hides or skins, and ranges from two hours up, depending also upon the method of tanning used, drum tanning being accomplished in much less time than when

paddle-vats are used. The tanning of the hides or skins is accomplished in one bath ; thus considerable labor is saved. The skins are not exposed to the destructive action of chromic acid as in two-bath tanning, and this results in making the leather stronger and not so liable to become papery or weak after it is dried out. There are no offensive or suffocating smells evolved ; and there is no danger of allowing the skins to remain in the liquors longer than is really necessary to tan them. The neutrality of the tanning liquor is of great assistance in the currying and finishing of the leather after it is tanned. The hides or skins are prepared for this method of tanning in the manner employed upon skins intended for any tannage, of which softness and smoothness of grain are important qualities. When the stock is tanned and is removed from the tanning bath, there is usually left in the liquor considerable tanning material. This should not be thrown away, but the skins may be put in and they will readily absorb the tanning material from the liquor. A new liquor can then be made and strengthened from time to time. In this way not a drop of the tanning material need be wasted, and the cost of tanning kept at the lowest point. When heavy hides are being tanned, it is good practice to suspend them on rockers in the vats so that the liquor may be gently agitated. If the hides are split after tanning, it is better to scour them with brush and slicker, or else mill them in a drum, and then return them to the liquor for at least twenty-four hours longer. Light skins, such as goat, sheep, calf and kangaroo skins, are preferably tanned in pin-mill drums, as less time is thus consumed than when vats are used. Such skins are tanned in drums in two or three hours. The plumpness of the leather may be increased by first treating the skins to a bath of alum or of sulphate of alumina and salt previous to the tanning in the chrome liquor. The solidity and firmness of the leather may be increased by treating the skins as they come from

the tanning bath to a bath of whiting and salt, made up in the proportions of ten pounds of common salt and five pounds of bottled whiting, mixed up in fifty gallons of water. This liquor is put in a drum along with the skins, and the skins drummed for about half an hour, then the whiting and salt are entirely removed by washing with clear water. All traces of the whiting must be removed. Fairly soft water should always be used in making up the tanning bath. Hard water contains lime and magnesia, and these cause the tanning material to be precipitated from the solution and render it unfit for use. When a quantity of the liquor is used in vats for different packs of skins, it is advantageous to correct the liquor by adding to it slowly and carefully a solution of sal soda, one pound of sal soda to three gallons of water. This soda solution should be added until the tan liquor appears cloudy, and its effect is to render the tan liquor so sensitive that it will yield to the skins the whole of the tanning material. Tan-olin is made and sold by the Martin Dennis Chrome Tannage Co., Newark, N. J.

The following process of chrome tanning produces leather that possesses the good qualities of both alum and chrome leather.

In appearance, plumpness, fine grain, softness and feel it resembles the former, and in softness and because of its insoluble nature it resembles the latter class of leather. The process consists of three consecutive steps or stages. The first step in the process consists of tawing the skins in a solution of sulphate of alumina and salt. In the second step the sulphate of alumina is fixed upon the fibres of the skins by means of a solution of hyposulphite of soda, and after this has been accomplished another solution of sulphate of alumina and salt is given to the skins, by means of which they are plumped, and the thinness that follows the use of hyposulphite of soda is overcome. When these things have been done, the skins are thoroughly alum

tawed, and if desired, they may be taken after the last treatment with alumina and salt, and finished without further tanning. To complete the process and to chrome tan the skins, they are taken after the final application of alumina and salt and given the chrome liquor. In practice the process is carried out as follows: The skins, after drenching and washing, are drained and weighed. For every hundred pounds of skins a solution is prepared, consisting of three pounds of sulphate of alumina, and six pounds of salt in three gallons of water, boiled and allowed to cool. In this solution the skins are drummed for twenty minutes. Then for each hundred pounds of skins in the drum ten pounds of hyposulphite of soda are dissolved in three gallons of water and this liquor is poured into the drum, and the skins drummed therein for fifteen minutes. To finish the first part of the process a third solution is prepared by dissolving in three gallons of water two pounds of sulphate of alumina and three pounds of salt. This is added to the contents of the drum, and the skins again drummed for thirty minutes or longer, or until they have acquired the requisite degree of plumpness and fullness. They are then taken from the drum and washed lightly by being dipped in clear water, and are then thrown over horses and allowed to press and drain for some hours. The old liquor being drawn off from the drum, the skins washed off in clear water to remove from them any excess of tawing materials, are ready to receive the chrome liquor. This is used without the addition of water or acid of any kind. For the chrome tanning of the skins from three to six gallons of the concentrated chrome liquor are required, according to the weight of the skins, for each hundred pounds of skins. The chrome liquor is prepared as follows: From five to six pounds of chrome alum are dissolved in five gallons of water, without heat. To the solution of chrome alum are added from two and one-half to three pounds of sodium sulphate, and from twelve ounces to one

pound of potassium or sodium acetate or its chemical equivalent. In a liquor thus prepared the skins are drummed for from thirty minutes to one hour, or until they have taken up all, or nearly all, of the liquor, and show thorough penetration of the same. At this point they will be found to be chrome tanned and insoluble in boiling water. The leather may next be taken from the drum and washed and finished in any manner desired in either colors or black, glazed or dull. When thick, heavy skins are being tanned, the quantity of chrome liquor used may be increased to six or seven gallons for each hundred pounds of skins. The sodium sulphate is the active agent in the solution, the sodium chloride or common salt being added to prevent merely the tightening or contracting of the fibres. The chloride may be omitted if the quantity of sulphate of sodium is increased by an amount equal to one-half the weight of the chloride as given in the above formula. In this process no free acids whatever are used. The skins are first tawed with alum and later it is treated with chromic oxide presented as an already reduced salt. Free acid in the solution added as an element, that is, other than as produced by the decomposition of the chemicals employed in the presence of the skins, will retard, if not prevent, the reaction necessary to produce leather. For this reason the skins must be entirely free from acid and perfectly neutral when the process is begun. Pickled skins, such as sheep and lamb skins, must be freed from the acid used as a pickle, by being drenched in a sour bran and salt drench before they are treated. After the tanning is completed the skins should be allowed to lie in the liquor for some hours, or over night, and then either thrown over horses or laid out flat in piles for twenty-four hours in order to give the tanning material taken up by them time to thoroughly act upon the fibres. After this the leather is washed for twenty minutes in warm borax water and then in clear water for twenty minutes, then shaved, colored and finished. This process is patented by Geo. W. Adler, Philadelphia, Pa.

Skins may be tanned with a liquor composed of whiting, salt, chrome alum, saltpetre and muriatic acid,

Either in drums or paddle vats. For this process they are prepared in the usual manner, and when tanned are very tough and flexible. In the preferred method of carrying out this process ten pounds of chrome alum, three pounds of saltpetre, six pounds of muriatic acid, fifteen pounds of salt and ten pounds of whiting are mixed with fifteen gallons of water. The whiting and salt are first mixed together at a temperature of about seventy degrees Fah., after which the other ingredients are added, and the mixture is then commingled with fifteen gallons of water. The skins are treated with this liquor in the usual manner. While the proportions of ingredients given above are the preferred ones, they may be changed considerably without changing the nature of the liquor or of the result.

Another one-bath chrome process

For which waterproof qualities are claimed is compounded in the following manner: Twelve pounds of chromic acid are dissolved in about six gallons of hydrochloric acid, the latter having a specific gravity of 1.146 and a hydrometer strength of 28.61. Fifty pounds of crystallized chrome alum are dissolved in about twenty gallons of water, without heat; and seventy-five pounds of crystallized carbonate of soda are dissolved in about ten gallons of water. Those solutions being obtained, the solution of soda is added slowly to the chrome alum solution, the latter being constantly agitated by stirring. When the compound assumes a cloudy appearance, and a fine sparkling mist is seen rising to the top, the addition of the soda solution should be discontinued and sufficient water added to bring the volume up to forty-four gallons. The next step is to thoroughly mix this compound of chrome alum and soda with the dissolved chromic acid before described, gently stirring the mixture while the mixing is going on. Then the combined

mixture should be allowed to stand and settle for twenty-four hours. The water in which the tanning is to take place should be heated to a temperature of eighty degrees Fah., and to every one hundred gallons of water one and one-half gallons of the concentrated tanning liquor are added, thus making a one and one-half per cent. liquor. The strength of the bath needs to be gradually increased during the treatment of the hides by the regular addition of more chrome liquor, in one-half gallon quantities, until the bath has had from four to five gallons of the concentrated liquor added for every one hundred gallons of water. The heat and strength of the bath should be maintained during the operation, and the hides or skins constantly stirred about. An experienced tanner will have no trouble in telling when the stock is tanned, but a good rule is to watch the hides or skins carefully, and when the thickest part of the heaviest skin shows a deep greenish-blue appearance all through, the tanning is completed. When it has been seen that the hides or skins are sufficiently tanned, they are removed from the bath and washed in water to which borax has been added, in proportion of one ounce to twenty gallons of water. The time required to tan with this process varies considerably. Sheep-skins usually require about one hour, and goat-skins about one and one-half hours. Calf-skins are tanned in from two to four hours, and hides in about ten hours. Skins tanned by this process are adapted for a great variety of purposes, and especially where waterproof stock is desired, as the skins are not deteriorated in any way by the treatment, but are left strong and pliable and susceptible of taking a high polish. The skins may also be tanned in drums. It usually requires about three gallons of liquor, prepared as described, to tan one hundred pounds of skins, weighed after drenching. After tanning, the skins are treated during the finishing process in the same manner as any chrome-tanned skins. This process is patented by Joseph W. Smith, Girard, Ohio.

A simple one-bath liquor

May be prepared by the following recipe: Three pounds of bichromate of potash are dissolved in hot water, and half a gallon of strong hydrochloric acid is added, and then glucose little by little, heating if necessary, until the yellow liquor changes to a deep blue-green. About one and one-half pounds of glucose are generally required. The solution is made up with water to two gallons. The goods are started in a two per cent. solution of the above liquor and gradually strengthened up to a six or eight per cent. solution. This liquor may also be used in drums and penetrates light skins in a short time, after which they should lie for twenty hours in a pile and then be washed in warm borax water, followed by clear water.

Another interesting one-bath tanning liquor is known as Chromine.

This liquor is also made under patents, and sold outright to tanners, in concentrated form ready for use. The principle involved in this process is the tanning of the skins with a liquid compound containing normal chloride of chromium and sulphate of sodium with an organic acid, such as formic acid or acetic acid. These are the principal active agents in the liquor, and are held in such relation to each other in the solution that the chromium and sodium salts are each severally capable of exerting its full tawing effects upon the skins. In carrying out the principle of the process a concentrated solution of the tawing liquor is prepared. This is done by first forming a compound of sulphate of potassium or of sodium with chromic acid by dissolving a given quantity of bichromate of potash or of soda in one and a half times its quantity by weight of sulphuric acid, mixed with double its volume of water. The chromic acid compound therein is then to be reduced to a sesqui-oxide by an organic reducing agent, and for this purpose sugar or alcohol may be used. To the resulting solution is then to be added a solution of

carbonate of soda, whereby it is neutralized and sodium combined with it, the result being sodium sulphate and formate or acetate, chromic hydrate and chromium oxycarbonate, the last two forming a precipitate, and this precipitate is then to be dissolved in the presence of hydrochloric acid.

The following are the proportions and method used in producing the results desired. Taking a given quantity of bichromate of potash or of soda, say five pounds, it is dissolved in fully one and a half times that quantity by weight, (seven and one-half to eight pounds of sulphuric acid,) diluted with double the quantity by volume of water that there is of acid used ; and this chromic acid compound so admixed with sodium or potassium sulphate is then to be completely reduced to a chromic oxide. The formation of this can be readily perceived by the liquid assuming a dark green color. The quantities named require about one pound of white sugar or one and one-half pints of alcohol, added slowly to keep the temperature below the point of ebullition and until effervescence ceases. The solution is then to be rendered neutral and sodium sulphate formed therein by adding to the quantity named about twenty pounds of carbonate of soda dissolved in about seven and one-half gallons of water. This sodium carbonate solution must be added slowly until the liquor ceases to effervesce. The mixture is then allowed to stand several hours until precipitation of the chromium oxycarbonate contained therein is complete. The last step in the preparation of the solution consists of adding hydrochloric acid, in quantity enough only to split up or decompose and completely dissolve all the precipitated chromium compound. For this purpose about six to seven pounds by weight of such acid will be sufficient for the quantities named, and twelve to twenty-four hours required for the purpose. Care must be taken that no more hydrochloric acid is used than is required to accomplish the desired object. When prepared as described, and the quantities are equally proportioned

the liquor obtained will be of about twenty to twenty-three degrees Beaumé, in density, and about sixty degrees Fah. of temperature, and from ten to twelve gallons of liquor in quantity.

The skins to be tanned are submitted to a bath of this liquor diluted to an extent varying according to the character of the skins, the length of time also varying for the same reason. Ordinarily the concentrated liquor should be diluted to an extent of three or four times its volume of water in order to reduce it to a hydrometric strength of five or six degrees. The skins take up the tanning material contained in the liquor in a very short time, the refuse liquor showing that all the salts have been absorbed. The tanner can readily determine when the process is completed by cutting into the thickest skin and noting the penetration of the liquor. The skins treated with this liquor become insoluble and perfectly tawed with a very fine and smooth grain surface. Pickled skins may be milled in salt water as usual, to remove the pickle from them, or they may be subjected in the pickled condition to this process. It is really immaterial whether the skins are milled in salt water or used in the pickled condition. The active salts in this liquor are the salts of chromium and sodium. These are in such relation to each other and to the organic acid combined with them that they are each severally capable of exerting their full effect as tawing agents, and each seems to modify the undesirable action of the other; *i. e.*, the sodium sulphate qualifies the usual astringent effect of the chromium salts, and the chloride of chromium qualifies or reduces the usual opening or swelling effect of the sodium salt, while at the same time the normal chromium salt in the compound will, on contact with the skin substance, give up the hydrochloric acid with which it is combined and be precipitated as an oxide, the reaction taking place in the fibre of the skin, which results in the skins becoming tawed and insoluble and finishing

into very soft and fine leather. A practical method of tanning light skins, such as goat, sheep and calf, with this one-bath process is carried out in the following manner: The skins as they come from the beam-house, washed and ready for tanning, are weighed, and for each hundred pounds a solution of sulphate of alumina and common salt is prepared, consisting of three pounds of the former and six pounds of the latter, dissolved in six gallons of water. In this liquor the skins are drummed for thirty minutes, or until they are full and plump. The skins can also be tanned direct from the washing, without the preliminary treatment with alumina and salt, if so desired. After the drumming in the solution of sulphate of alumina and salt, the concentrated tawing liquor is given to the skins, in quantity about six gallons for each hundred pounds of skins in the drum. The drumming in the liquor should be continued for two to three hours until the skins are completely tanned, then they may be removed from the drum, washed in the usual way and finished. The process may also be carried out in vats, the quantity of liquor used being about the same, and the skins paddled until they are tanned. This process is not all astringent, the grain of the skins remaining smooth and without any contraction whatever. Chromine is manufactured under patents by The Eureka Tannage Co., Philadelphia, Pa.

A liquor useful in one-bath chrome tanning that has been used to some extent is called Progress Tan Liquor.

This is used in tanning skins in the following manner. After slating, wash the skins in a weak solution of muriatic acid, using about two pounds of acid in three hundred and fifty gallons of water for twelve hundred pounds of skins, weighed after slating. Process the skins in this acid liquor in a paddle-wheel for about thirty minutes. The temperature of the liquor should be lukewarm. From this washing, the skins are placed in a drum, and to every hundred

pounds of skins add from two and one-half to three and one-half pounds of sulphate of alumina, and from six to twelve pounds of salt. For soft skins use the smaller quantity, for hard skins the larger quantity of alumina and salt. The quantities of alum and salt may be varied between the lowest and the highest proportion, according to the nature of the skins. The sulphate of alumina and salt may be dissolved before using or they may be put into the drum in dry state. The skins should be drummed in this for from thirty minutes to one hour, and they should be free from stringiness when they are pulled out in the flank after drumming in the alumina and salt. When in this condition pour five gallons of the tan liquor to every hundred pounds of skins into the drum through the gudgeon while the drum is running. Then drum the skins in this liquor for three hours, or until they are tanned.

When the skins have been drummed enough, the liquor runs from them colorless. Now take them from the drum, stretch them on horses and allow them to remain there and press until the next morning. Then strike them out and shave them. For very heavy skins, they should be taken after shaving, put back into the drum with the spent liquor from the first tanning. Allow one gallon of tan liquor for every hundred pounds of skins as they weighed originally, and drum them in this liquor for one and one-half hours. This completes tanning. A thorough washing is required, and this may continue for one hour, using running water; then strike out the leather and proceed to stain, color and finish. The leather made in this way is tough and has a fine smooth grain, there being no contraction. Another method of using this liquor that produces salable leather, is to tan the skins direct from the drenches without the use of alum and salt, nor of muriatic acid. For one hundred pounds of pelt, weight to be determined after drenching and washing, from six to eight gallons of the tan liquor are

used. The exact quantity best adapted for the stock must be determined by the tanner. The tan liquor may be mixed with twenty-four gallons of water. Of this, put sixteen gallons in the drum and run the skins for one-half hour, then put in a few more gallons and run the drum another half hour, then put in the remaining liquor and drum the skins long enough to thoroughly tan them, which ranges from two to five hours, according to the thickness of the skins. The whole of the prepared liquor may be put into the drum at once, and also less water may be used. After tanning, the leather should be washed until all traces of tan liquor have disappeared. Progress Tan Liquor is one of the specialties of the Wolfe Chemical Co., Philadelphia, Pa.

Vacrome

Is the name given to a single-bath mineral tanning agent, by the use of which chrome leather is made in one-third of the time and with one-half the labor required in any two-bath process. This liquor is not astringent, and therefore it does not contract nor damage the grain and fibre of the skins. When any one-bath process is used, if after the stock is shaved it proves to be not uniformly tanned, it can be returned to the liquor and re-tanned in the same manner as with the use of vegetable tanning agents. Vacrome is made by the Vacuum Oil Co., Rochester, N. Y.

In practice, this tanning material is used as follows: After the stock comes from the drench or wash-wheels, it should be placed in a drum with water at a temperature of sixty-five degrees, adding four pounds of salt for each one hundred pounds of stock, weighed as it comes from the beam-house. In this the stock is run for not more than five minutes. Then is added one gallon of the Vacrome for each hundred pounds of skins in the drum, and the drum run for thirty minutes. Then another gallon of tanning liquor is added and the stock drummed for thirty minutes,

then another gallon is added and the drumming continued for from one to two hours longer or until the stock is thoroughly tanned.

The stock should be left in the tanning solution after being tanned through for twenty-four hours, or it may be placed in a pile for the same length of time, thus permitting the salts held in solution to act upon the pelt, at the end of which time stock should be washed for thirty minutes in warm water at a temperature of one hundred degrees, and for thirty minutes in cold water, and it is then ready for the color bath. While there is no pickling before tanning nor washing in soda solutions after, yet washing for one hour preparatory to coloring will not remove any of the tanning matter. All tanning matter taken up by the stock is retained. Pickled sheep and lamb-skins are prepared for tanning by first wringing or pressing them to rid them of animal grease, then they are washed in warm salt water to soften them and to free them from surface grease. The pickle is next removed. For ten dozen medium-size sheep-skins use twenty-four quarts of salt and four pounds of whiting in water at a temperature of ninety degrees. Run twenty minutes in a pin-wheel and then let skins remain in the bath without milling for one-half hour, after which take skins from the bath and throw them into a light sour-bran drench for half an hour, adding sufficient water to keep skins from swelling, after which wash them in clean salt water to remove all traces of the whiting. Precaution must be taken to remove all the whiting from the skins, otherwise they will be harsh and brittle after drying out, also plenty of salt must be used in washing to keep the skins from swelling. It is also necessary that all acid used in pickling should be removed from the skins before they are placed in the tanning liquor. Sheep-skins are tanned through in two and one-half hours, if all the grease and acid have been previously extracted. For three hundred pounds of skins, fifty gallons of water should be used for

the bath, and two and one-half gallons tanning fluid for each hundred pounds of skins. When the tanning is done in paddle-vats, the liquor is fed more slowly, although the quantity is about the same. Twenty-four hours is the maximum time required with this process in paddle-wheel tanning.

By the use of chrome-alum, liquors can be made that have given good results when used upon light skins.

One formula calls for sixteen pounds of chrome-alum, one and one-half pounds of ordinary alum, and one-half pound of iron-alum dissolved in eighteen gallons of cold water. This requires considerable time, as the water must be cold. No heat can be employed. Five pounds of common washing-soda are separately dissolved in two gallons of water. After the alums have gone into solution, the soda-liquor is gradually added to the alum liquor, the latter being constantly stirred. Prepared in this way, about twenty-two gallons of stock liquor will result. This will tan from one hundred to one hundred and fifty pounds of skins. The tannage is best accomplished in a drum. The prepared skins are entered, and to every one hundred pounds of skins five gallons of water are added and ten pounds of salt. About two pounds of alum may also be used. In this solution the skins are drummed for thirty minutes, after which the tanning liquor as above prepared is added. Two or three gallons may be added at a time at intervals of fifteen minutes, and the drumming continued for several hours until the skins are tanned. Then they are washed in the usual way, first with borax and water, and then with clear water for three-quarters of an hour, and are then struck out or pressed and are ready for fat-liquoring.

Skins may also be tanned with a liquor prepared as follows :

Ten pounds of chrome-alum are dissolved in ten gallons

of cold water. This requires some time, and the alum needs to be stirred about occasionally, or it may be hung in a basket in the water and dissolved in this way. Two and one-half pounds of ordinary washing-soda are separately dissolved in one gallon of water. The soda solution is then slowly stirred into the chrome-alum liquor. The tannage may be carried out in vats by adding three gallons of the liquor to eighty gallons of water, with seven pounds of salt. At intervals of one hour three gallons of the liquor are added, and the skins paddled until the strength is exhausted and the skins are tanned. In a drum, from two to three hours are required, and the ten gallons of liquor will tan one hundred pounds of skins.

CHAPTER XI.

DEER-SKINS.

A VERY good method of removing the hair from deer-skins is to paint the skins on the flesh side with either a mixture of lime and sulphide of sodium or a clear solution of the latter article. The skins require a thorough soaking and softening in water before they are painted, in order to rid them of salt, dirt and blood. The strength of the sulphide of sodium liquor is not arbitrary, but may vary from twelve to twenty-four degrees, tested by the hydrometer. A good liquor is one of about eighteen degrees. Before the lime is used it should be reduced to milk of lime by the use of hot water, and it should be, as well as the sulphide of sodium liquor, perfectly cold before being applied to the skins. When preparing a new depilating liquor, about one-half of a barrel of lime may be used in fifty gallons of hot water. After the lime becomes thoroughly dissolved and reduced to milk of lime, several pailfuls may be mixed with a barrel of the sulphide of sodium liquor. The deer-skins are spread out upon a smooth surface, and the mixture of lime and sulphide of sodium applied to the flesh side. It should be put on with a vegetable fibre brush or a swab of burlap and spread on evenly without running off.

The skins are then folded up and placed in piles for some hours, or until the next day, when the hair will come readily off, and the skins can then be limed for a number of days in order to get the desired softness at the start. The painting of the skins and the removal of the hair should be done in a cool moist room, so that the skins will neither dry nor heat. After the hair has been removed from the

skins, they should at once be put into clean cold water and left therein until they are to go into the liming process. In this way they will be safe from heating, drying out or spoiling. The object of liming the skins is to increase their softness and elasticity, qualities that are so much desired in glove leather. In making a new lime, two buckets of lime are slaked in about ten gallons of hot water. This quantity of lime will answer for from three hundred to four hundred skins. The skins should remain in the first lime for one day, then hauled out and the same quantity of lime added as was used in the first instance. This may be repeated for six or eight days and results in making the skins exceedingly soft and stretchy.

The grain of the skins may be removed after the liming, either by shaving it off or by frizzing it off on a machine. After this is done, or if the grain is left on the skins, they are thoroughly drenched to rid them of the lime and to make them soft and clean. Any of the usual methods of drenching skins may be used. As the skins have been heavily limed, it is necessary to drench them thoroughly. The skins may be tanned in various ways. Oil tannages and the chrome processes make very good leather, also alum and napa tannages.

The following process, although originally applied only to sheep-skins, produces good results upon deer-skins,

As the leather it makes combines the qualities of softness and toughness, which allow the leather to be sewed into gloves without allowing the stitches to tear out. As the skins come from the beam-house, ready for tanning, they are treated with a solution composed, for two hundred skins, of the following ingredients: Twenty pounds of salt, thirty pounds of white rock potash and three hundred gallons of water. The skins may be left in the solution for about two hours, or they may be processed in a drum for twenty to thirty minutes, and are then wrung out dry and

immersed in a solution composed as follows: Twelve pounds of hard soap and two gallons of neatsfoot oil in one hundred and fifty gallons of water. The skins require to be left in this solution long enough to become wet through, and are then removed and hung up and dried out. They are treated in this way, wetting in the liquor and drying out two or three times. After being thus treated and properly tawed, they are put, in the dry state, into clear water and washed in a thorough manner to remove all foreign matter from them, and in this moist condition are dried to produce leather of various colors, or they may be dried out without further treatment and will make a white leather.

Another process that results in soft tough leather consists in subjecting the skins, as they come from the drenching and washing, to a liquor composed of two pounds of caustic soda, one pound of borax and sufficient water to cover the skins, say one hundred gallons. The quantities named are sufficient for one hundred and twenty average size skins. The skins are drummed in this liquor for one-half hour, and are then removed and hung up and dried out. The dried skins are next placed in a solution composed of five pounds of hard soap, one gallon of straits oil, one-half pound of caustic soda and seventy-five gallons of water. The skins require to be left in this solution until they have become wet through and soft, after which they are placed in a drum with some of the liquor and drummed therein for one-half hour, being then removed and dried out as before. The skins are next drummed again in part of the second solution and then hung up and dried out again. Sometimes this process needs to be repeated two or three times until satisfactory leather results. When they are dried out without further coloring, the skins are nearly white. They may be colored any shade or smoked, and will be found to be very soft, tough and strong.

When the grain has been removed from the skins in

the bean-house, the skins may be satisfactorily tanned in the following manner : For two dozen skins of average size, a solution is prepared of one pound of alum, one and one-half gallons of water, one-half pound each of flour and oatmeal or one pound of either alone, with one gill of oil and enough water to make a total of three gallons of liquor for each two dozen skins. In this liquor the skins are drummed for about thirty minutes, after which they are allowed to drain and are then drummed in a liquor composed of one gill of ammonia, one-half bar of soap, one-half ounce of soda, one-half pound of salt and about two ounces of ochre, all boiled in two gallons of water, until they are thoroughly dissolved, to which are added one-half pound of flour and one-half pound of oatmeal or one pound of either alone, mixed in one and one-half gallons of water. In this liquor the skins are drummed for thirty minutes, then dried out, staked and finished upon either side in the usual manner.

The skins may be treated in the first liquor and then dried out and worked soft without the use of the second liquor. Still, in the majority of cases it is best to use the entire process, and when finished they bear a close resemblance to castor glove leather.

Deer-skins may also be satisfactorily tanned in a liquor

Composed of the following articles in the proportions named : Seven pounds of alum, three pounds of glauber salt, four pounds of common salt, ten gallons of soft water, five pounds of ground sumac, three pounds of oak bark, one pound of ground nutgalls and four ounces of oil of vitriol. The alum, glauber and common salt, in the quantities named, are reduced to a fine powder by any suitable means and then dissolved by boiling in the ten gallons of water. The sumac, oak bark and nutgalls are then mixed together and boiled briskly for twenty minutes, more or less, then the mixture while hot is strained over the alum

and salts mixed together as has been stated; the four ounces of oil of vitriol are then added and the liquor thoroughly stirred. In the liquor thus compounded the prepared skins are placed, the liquor being lukewarm, and the skins left therein for at least twenty-four hours. During the first few hours the skins may be stirred about, or they may be drummed in the liquor in the drum for one hour and then allowed to rest in the liquor for some hours. When the tanning is completed, the skins are removed from the liquor, and after being allowed to drip they are set out on both sides, a glass slicker being used for the grain side. A heavy coat of lard oil is then applied to both sides; then the skins are hung in a warm place until they become dry. This process in a short time produces very soft leather and at small expense.

Tawing with sulphate of alumina.

If a superior quality of alum-tawed leather is wanted, of full plump body and of fine texture, the skins may be tawed in the following manner: As they come from the beam-house and without pickling, they are weighed, and for each one hundred pounds of skins ready for tawing, three pounds of sulphate of alumina and six pounds of salt are dissolved in six gallons of water. This liquor is placed in a drum with the skins and the skins drummed for thirty minutes. Then to fix the tawing materials upon the fibres of the skins about ten pounds of hyposulphite of soda are dissolved in five gallons of water, and this solution poured into the drum and the drumming continued for another thirty minutes. Then to overcome the thinness of the skins caused by the hyposulphite of soda, another solution of sulphate of alumina and salt is added. This may consist of two pounds of alumina and three pounds of salt dissolved in four gallons of water. This solution plumps the skins and completes the process. The skins, after being taken from the drum, are thrown over horses and

allowed to press and drain for some hours, after which they are rinsed off by being dipped into water, and dried out and finished the same as chrome-tanned skins. Egg yolk and neatsfoot oil may be used to soften the leather, a heavy coat of the oil being applied to the flesh side. The softness of the skins is largely produced by the tannage and the nature of the articles used in nourishing the leather after it is tanned. Olive oil produces good results when used with egg yolk, but it is too expensive for general common use. The greases should be thoroughly absorbed by the skins before they are dried out. Fat-liquors composed of soap, oil and egg-yolk give great softness and strength to the leather and do not streak or spot the whitest or most delicately-tinted leather. When the skins are colored in drums, the fat-liquoring should not be done until after the coloring. A mixture of flour and water is sometimes added to the fat-liquor for the purpose of increasing the fullness and plumpness of the leather. A tannage of salt, alum, flour and oil produces very soft and elastic leather. The tawing is done the best in drums, and the skins drummed in the paste of salt, alum, flour and oil until all the ingredients are absorbed, then they are dried out, dumped back and finished in the usual manner. All excess of tawing materials should be removed before the leather is colored, as this has much to do with getting clear and uniform shades.

An old-fashioned and very simple method of tanning deer-skins

Consists of washing the skins in the usual way, and after they have been well and heavily limed, they are drenched in a sour-bran drench. After liming, and before drenching, the grain is shaved off, and after washing and drenching, the skins are well drained; they are given heavy coats of oil on both the grain and flesh sides, rolled up for a few days and then hung up and dried out. After the skins become dry they should be washed in warm soap-suds and

the soap-suds left in the skins, and the leather dried out again. During the drying, the skins should be worked until they become thoroughly soft and dry. Treated in this way, the skins become as soft as chamois. The oil may be driven into the skins by means of mills, and the work thus hastened and better results secured.

The drying of the leather should take place in a moderately warm room, so as not to parch the skins, and while drying they should be worked occasionally, so that the drying and softening will be accomplished at the same time.

The chrome methods of tanning seem especially adapted to deer-skins,

As they produce good, tough and yet very soft leather. Before being chrome-tanned, the skins require a very thorough liming and drenching, and after tanning they are given more fat-liquor than skins intended for shoe purposes. Dirty limes and dirty soaks are fatal to the best results in the leather. It is essential that all the lime be gotten rid of before the skins are tanned; the more thoroughly the skins are reduced, the softer will be the finished leather. After drenching, the skins may be pickled in a solution of sulphuric acid, salt and water, or they may be tanned without pickling, by being tanned at once in the chrome liquor. When they are tanned without pickling, it is good practice to drum them in a solution of sulphate of alumina and salt, using about three pounds of the former and six pounds of the latter, dissolved in six gallons of water, for every one hundred pounds of skins. The skins may be drummed in this liquor for three-quarters of an hour and then given the chrome liquor. When convenient to do so, the skins should be thrown over horses, after the drumming in alumina and salt, for twenty-four hours before they are tanned in the chrome liquor. In drum tanning, three gallons of concentrated tanning liquor are usually required

for every one hundred pounds of skins, although the quantity varies. Some liquors must be used in quantity, five or six gallons for every hundred weight of stock. A drumming for three hours in the chrome liquor will cause the skins to be well struck with the liquor, and after this they should lie in the liquor one day, in order that the salts taken up by them may have time to exert their full tawing powers upon the skins. After this the skins should be washed for about twenty minutes in borax water and then for twenty minutes in clean water. This washes out all the salt, alum and tanning liquor and leaves the skins in right condition for coloring and finishing.

A good method of chrome-tanning the skins

Consists of pickling the skins as they come from the process of drenching in a solution of salt, sulphuric acid and water, made up of two and one-half quarts of the acid and sixty pounds of salt for one hundred skins. In this pickle the skins may remain six hours, and are then removed and allowed to drain well before tanning. Then the pickled skins are placed in a drum with a solution of glauber salt, composed of one pound of the salt dissolved in eight gallons of warm water for every one hundred pounds of skins. The skins are drummed in this liquor for fifteen minutes. Then the liquor is drained out of the drum and replaced by a solution of common salt, ten pounds of salt in eight gallons of water for each one hundred pounds of skins. In this the skins are drummed for five minutes, after which the chrome liquor is added in quantity about three gallons for each one hundred pounds of skins. It should be added, a gallon at a time, at intervals of one-half hour, and the skins drummed therein for three hours. One-half pound of bicarbonate of soda is next dissolved in one gallon water and added to the contents of the drum and the drum run for one-half hour longer, after which the tanning should be complete, although the skins should be allowed to lie in the

liquor over night, and be then thoroughly washed for at least thirty minutes.

In order that the skins may take the colors right, the skins must be perfectly neutral and clean. This is accomplished by the washing; and borax is a good article to use to accomplish the object, as it not only removes the acids, but leaves the skins soft and smooth. When acid is left in the leather, especially when a two-bath process of tanning is used, it works upon the oils and fat-liquors and causes a mouldy and sticky appearance in the leather; also causes the leather to become hard and papery after being finished for a time. In addition it weakens the strength of the fibers and causes the leather soon to wear out.

Deer-skins may also be very nicely tanned by any of the two-bath processes

That have been already described. The important point to be observed in using the two-bath processes is to be sure that the chrome liquor of the first bath has penetrated every fibre of the thickest skin before the stock is placed in the second bath. The first bath may be applied to the skins in a drum, and the second bath in a paddle vat. After the skins are tanned in either one-bath or two-bath processes, they may be washed thoroughly and left for a few hours in a warm bath of sumac. This leaves the skins almost white, and if they are to be colored fancy shades, the sumac acts as a mordant.

The skins, as they come from the tanning liquor, should be very thoroughly washed and then the surplus water struck or pressed out of them before they are colored and dried out. After coloring, the skins should be again washed off and pressed and then fat-liquored. The quality of the leather largely depends upon the materials used in greasing the leather after it is tanned. Emulsions of soap and oil are generally used and impart great strength, softness and fineness to the leather. A point of importance is that the

ingredients of the fat-liquor must be thoroughly combined with each other to get the best results. A very good fat-liquor for glove leather is made of ten pounds of Palermo fig soap or another suitable potash one, four gallons of neats-foot oil and ten pounds of egg-yolk in fifty gallons of water. The soap is first boiled in about ten gallons of water, then the oil is cut with a few ounces of sal soda or borax and mixed with the boiled soap. Cold water is next run in until the temperature is about seventy-five degrees, then the egg-yolk is added and the mixture applied to the skins in a drum at a temperature not less than ninety degrees Fah. The fat-liquor should be added, a gallon or two at a time, until it is all in, and then the leather drummed in it for not less than thirty minutes or until the grease has been all absorbed by the leather and nothing but water is left behind. After the fat-liquoring, the skins should be laid in piles or thrown over horses for some hours to enable the grease to become thoroughly incorporated with the leather before it is dried out.

The best results follow when the skins are colored before being fat-liquored. The drum method of coloring is generally preferred, as it produces more uniform results and takes up less time than other methods. For mordants, sumac and fustic are generally used.

A somewhat crude process of tanning deer-skins,

In use among the Indians, who are noted for making buckskins as soft and strong as velvet, is carried out as follows: Take a skin, either green or well soaked, and flesh it clean, then unhair in any suitable manner. Then remove the grain and prepare the skin for tanning by drenching and washing. Take the brains of the animal, dry them gently by the fire, put them into a cloth and boil them until they are soft, cool off the liquid until bloodwarm with water sufficient to soak the skin in, and soak the skin until it is soaked thoroughly with the liquor, and then wring it out

as dry as possible; wash in strong soap-suds, rub dry and smoke with wood smoke. Instead of brains, oil or lard may be used, and the skin soaked therein for six hours, then dried out.

When deer-skins are to be oil or chamois tanned,

They should be very thoroughly limed from eight to ten days, and after unhairing, the grain should be removed by any suitable machine or means. A further liming for a few days after the graining is an advantage, as it makes the skins more elastic and porous. Old lime liquors produce the best results, provided they are kept clean, as they make the fibres of the skin very soft and fine and free from the harshness that new fresh lime produces.

To remove the lime from the skins, a manure bate may be used, followed by a bran drench or a drench of lactic acid. The manure process of bating makes the skins very soft and stretchy, but it is best to combine it with some other drench, so that the skins may be entirely freed of all lime without injury. The manure bate, however, is not necessary, as good leather can be made by merely washing the skins in a warm lactic acid bath in a drum, made up of one gallon of acid in one hundred gallons of warm water 90° F. After bating and drenching, the skins should be washed off and are then ready for tanning in oil.

Before the skins are treated with oil, they should be pressed in a hydraulic press, in order to rid them of all surplus and unnecessary water, thus making them as dry as possible and still retaining moisture. They should then be given a thorough beating with machinery especially constructed for the purpose, in order to soften them, after which they are sprinkled with cod-liver oil and are again beaten, in order to force the oil into the leather. The best grade of New Foundland cod oil is considered the best for the purpose. The process of oiling and beating the skins is repeated two or three times, or until they have lost their

original odor and have acquired a mustard color. After the oiling and beating process is completed, the skins are made to undergo a process of heating. By this process, the oxidation of the oil, which was commenced during the previous process, is completed by the fermentation that takes place in the skins. The heat is generated spontaneously. The skins must be watched very closely and frequently turned over. When the heat is allowed to rise to a high temperature, the leather is seriously damaged. The heat as generated destroys all organic matter in the skins. The highest temperature allowable is 140 degrees F. This process of heating is a most delicate operation, and upon its being properly done depends the success of the leather.

When insufficient heat is generated, the leather rots; when too much heat is produced, it becomes dissolved. When the fermentation ceases and the skins are no longer susceptible to heating, they are treated to remove the oil. This is done by washing the leather in hot water and then subjecting it to a hydraulic press. The grease that is squeezed out in this way is *degras*, largely used by curriers of leather. The surplus oil may also be removed by washing the skins in a solution of soda ash, which causes the grease remaining to saponify. The saponified oil removed by pressure is neutralized with sulphuric acid and becomes the oil known as *sod oil*. A certain proportion of the oil is, of course, allowed to remain in the skins, so as to give them softness. The finishing process consists of drying, working out and smoothing down all unevenness on the surface.

The skins may be bleached by being sprinkled with water and exposed to the sun, or by treatment with a weak solution of permanganate of potash, followed by a treatment with diluted sulphuric acid, or the leather may be treated with sulphurous acid in the form of gas.

Methods of handling the skins vary. In some instances the skins, instead of being laid in piles to ferment, are

hung up in warm closed rooms or ovens, which is less dangerous and produces a better color.

Very soft tough leather may be made of deer-skins

By first treating them to a solution made up of nine pounds of alum, six pounds of salt, twenty pounds of wheat flour and twelve pounds of egg yolk, thoroughly mingled together in twelve gallons of warm water, and used for each one hundred pounds of skins at a temperature of 90 degrees. The skins are drummed in this liquor for thirty minutes, and then hung up and dried out. Instead of twelve pounds of egg yolk, six pounds of the same and six pounds of olive oil may be used. After being left in the dry state for some weeks to cure, the skins may be worked out soft and finished without further treatment, or they may be washed in warm water and then tanned in a one-bath chrome process. Oil-tanned or chamois leather may also be made by passing the prepared skins (after bating, washing and pressing) through a twenty-five per cent. solution of Turkey-red oil. This may be accomplished by having the solution warm and passing the skins through the same, or by treating them with the solution in a drum. After the treatment with oil, the skins are dried out and placed in a heap in a moderately warm room and covered up for a day or two. They are then hung up in the air and allowed to dry slowly, after which they are again treated with the soluble oil in the same manner as at first, again laid in a heap, dried out again, and then washed in a weak solution of borax or other alkali. By drying and working, the skins are made very soft and completely oil tanned.

The results may be changed and modified by greater or less concentration of the oil solution; by higher temperature in drying and by a greater number of applications of the oil. The skins may also be tanned by combining the oil with the salts of alumina. The preferred method of doing this is to steep the prepared skins in a solution con-

taining preferably fifteen per cent. of the Turkey-red oil, and then drying them out. The operation may be repeated, and then the regular method of tanning with the alumina salts proceeded with in the usual way.

CHAPTER XII.

PATENTED METHODS OF DEPILATING.

METHODS OF USING NEW XXX DEPILATORY, PATENTED.

IN addition to sulphide of sodium, used for the purpose of removing hair and wool from the hides and skins and preparing them for tanning, there is on the market a patented depilatory, known as New XXX Depilatory. This material is a very satisfactory article for both wool-pullers and tanners to use, and leather that has been treated with it is characterized by great toughness, pliability and fine close grain. New XXX Depilatory is used upon the various classes of hides and skins in the following manners: The depilatory crystals should first be dissolved into a liquid with boiling water or steam; being a compound, the material is simply reduced with hot water and not allowed to settle, but the whole liquor is used, as the settlings are a most valuable part of the preparation, forming a slight carrying body, which adheres to the skins and will not gum or injure the wool, but on the contrary makes it clean, soft and silky, equal to sweated wool. The strength of the solution should be for salted skins, 12 to 24 degrees Beaumé; thin open wool skins, 14 to 18 degrees; thick heavy merino and bucks, 18 to 24 degrees; milk lambs, 18 to 24 degrees; used upon goat and kid skins at the same strengths as upon sheep and lamb-skins. The strength, however, need never be greater than just sufficient to start the wool or hair; if applied stronger than this, no injury results to the skins, the material is merely wasted.

The skin should never be allowed to heat before or after treatment, nor in any stage of the process. Salted or dried

skins should be soaked from twenty-four to sixty hours, and after washing and breaking thoroughly, should be well drained of water or extracted before painting with depilatory. The wool or hair usually starts in a few hours after painting, and it is well to pull or unhair promptly, say the next day. Milk or young lamb and kid-skins on which the depilatory is used full strength, should be pulled as soon as the wool or hair starts, and immediately put into clean, cold water and then limed very lightly from six to eighteen hours. All slats, after pulling and unhairing, should be immediately put into cold water, to which some depilatory has been added; in this the skins are safe for a good while, and in no danger of heating, pricking or spoiling. No depilatory-treated skin can be injured so long as the skin is kept moist and not allowed to dry out or become hard. The first lime can be half renewed for each batch of skins by adding one bucketful of lime for every four hundred skins, and should always be kept clean and sweet, and only used once; and the slats may remain in this lime over night or from twelve to fifteen hours in warm weather, and from twelve to thirty-six hours in cold weather.

The second lime should be made entirely fresh, using about two buckets of lime to every four hundred skins. The slats can remain in this lime from one to two days in hot weather, and two to four days in cold weather, then they will be sufficiently limed for ordinary purposes. If they are to be tanned without pickling, a little more lime may be necessary and will do no harm; if high-limed stock is desired, a third, and even a fourth lime may be used. It will be found advantageous to pull the slats out daily while liming in case still limes are used, and it should always be borne in mind that the stronger the solution of depilatory is, and the less it is washed out before liming, the weaker and less liming are required. After the skins are taken out of the lime vats, they should be washed in

clean cold water and are then ready for fleshing or the drench, out of which, work on the grain side and trim, putting them again into clean water as fast as worked, and from this water flesh them well on the beams or machine.

In the treatment of light hair skins, such as goat and kangaroo-skins, when it is not desired to save the hair, the skins can be soaked and softened, and then put into a liquor made up of from ten to fifteen pounds of depilatory to every one hundred gallons of water in the vat. The depilatory should all be dissolved and the liquor well stirred up before the skins are put in. To keep the skins in a solution prepared in this manner for twenty-four hours, with occasional stirring about, results in reducing the hair to pulp, which can be easily removed from the skins by washing them for a few minutes in clean cold water. The mixing of lime with the depilatory is not recommended, as the stock is not quite so soft as when the depilatory is used alone. In case dry skins do not get thoroughly soaked and softened before they are put into the solution of depilatory, they may remain in the liquor from twenty-four to forty-eight hours, according to strength of the liquor and condition of the skins until they are thoroughly soft and plump. No lime should be applied until the skins are completely softened. After the skins are washed to remove the dissolved hair, they may be lightly limed for a few days and then fleshed and drenched.

If it is desired to save the hair, the skins should be soaked in the usual way and then the water extracted by means of a hydro-extractor, or by the skins draining thoroughly. Then they may be painted with the solution of depilatory, at a strength of eighteen degrees, each skin then folded up, flesh side in, and allowed to lie until the next day, then the hair may be easily rubbed off, the skins washed and limed for a few days. Any one of the well-known methods of drenching skins after liming may be used. Manures are disagreeable and somewhat risky.

Lactic acid and some of the chemical bates are safe and cheap. Bran may also be used with good results when it is properly applied. For the finer grades of skins it is sometimes necessary to work them thoroughly upon the grain after drenching to remove all lime and impurities and then to wash them in warm water, when they will be ready for pickling or tanning. It is always good practice to handle the skins promptly and to allow no delay to take place between the operations, especially in hot weather. The limes should be kept sweet and clean and the skins handled frequently and carefully drenched, as it is during these processes that the character of the leather is made.

When New XXX Depilatory is used upon hides intended for sole leather, the unhairing should take place as promptly as possible and in such a manner as not to affect the weight of the hides, nor to remove substance and impair the strength of the leather. The usual method employed is, after the hide is soaked, it is spread out on a smooth surface, hair uppermost. If no value is placed on the hair, the hair side is painted with depilatory, used either clear or mixed with lime, well-slaked lime, three parts, depilatory liquor about eighteen degrees strength, one part. The lime should be well slaked, and the depilatory crystals dissolved before being mixed. To apply the same, a vegetable fibre or tampico brush or swab made of burlap or bagging may be used.

After the mixture has been applied evenly over the hide, the leather should be doubled up carefully and covered up so as to exclude the air and prevent the drying of the paste. If the hair is to be saved, the hides should be painted on the flesh side and the hair kept clean. The hides should be kept in a cool damp place until the hair starts, then opened out, washed in clean cold water and un-haired; then fleshed and the grain worked and washed when the hides are ready for tanning.

The unhairing can be done another way. A vat is filled

with water, and from one-half to three-fourths lime, and one-fourth to one-half dissolved depilatory liquor, eighteen or twenty degrees strength, added thereto and well mixed. Then the hides are thrown in and left in the liquor over night or from one day until the next. The use of lime is not necessary ; a liquor of nothing but depilatory crystals of a strength of from five to ten degrees may be used. In this the hides may remain until they are thoroughly soft and the hair comes off readily. All tanning operations are the same as sweated or limed hides, except that slightly stronger liquors are required. It must be mentioned here that only hides intended for heavy leather should be treated in the above manner. The hair is lost, but this loss is more than made up by the extra quality and increased weight gained in the leather, the superior fine close grain, exceeding toughness and pliability and great saving of time and labor.

For upper, belting, harness, enameled and patent leather, also calf-skins, the hides or skins may be painted on the grain or flesh side and washed or unhaired as soon as the hair becomes loosened, which will be in from twelve to twenty-four hours, depending upon the thickness and condition of the hides or skins, and the temperature and strength of the depilatory liquor. If no value is placed upon the hair, the vat method may be used. When it is desired to save the hair it should be promptly and well washed and spread out to dry as soon as convenient after being taken off. Dry foreign hides, kips, etc., must be brought to natural condition of softness by thorough soaking in water, fulling and stretching. This work can be greatly hastened and facilitated by dissolving and adding to the soaks about one-eighth of an ounce of depilatory for each hide or skin to be soaked.

By painting the hides or skins as has been described, and after unhairing, a further liming or swelling may be considered necessary for easier fleshing, scraping, beaming

or splitting. This can be done by means of depilatory water alone, which can be made new, or the water the painted hides have been washed in after unhairing can be saved for the purpose. or weak clean limes, as for goat and sheep-skins, can be used. But in any case the liquor should be well stirred and mixed before the hides are put in. The strength of the liquor can be reduced or increased as circumstances require. The proportion of depilatory necessary for liming and swelling purposes is about one to one and one-half ounces for each hide; one-half to three-fourths of an ounce for each kip; and one-fourth to three-eighths of an ounce for each calf-skin. If the water is hard, a little more may be used. The swelling and liming are usually completed in from one to four days, depending upon the nature and condition of the hides or skins, the strength of the liquor and the weather and temperature of the limes.

All hides intended for splitting after unhairing, can be plumped or swelled much better with depilatory water, or with clean well slaked lime with depilatory water added, from one-fourth to three ounces of depilatory for each hide, depending on size and thickness. It will require from one to five days. The tanner must use his judgment as to these matters, and if the right results are not obtained on first trial, something has been done wrong. It is also important that the hides or skins be opened out, examined and handled daily; the scraping, fleshing and shaving can be done immediately after unhairing or after swelling. Any stray hairs that may remain can easily be removed when cleaning the grain after swelling. A thorough cleaning of the grain is generally superfluous, it being usually smooth and clean, as nothing touches it to make it unclean. A slight washing in warm water is sufficient to cause the stray hairs to come off. For some kinds of stock an oat straw or bran drench will tend to soften and improve the grain.

If no value is placed on the hair, the painting of hides, kips, calf-skins and other skins intended for tough upper leather may be dispensed with, and no lime need be used. From twelve to forty-eight ounces of depilatory dissolved and added to every fifteen gallons of water in the vat, may be used. According to strength of this liquor the hides or skins will unhair in two or three days and will be sufficiently swelled to be fleshed, beamed and split. The time can be increased or shortened by using more or less depilatory in the water. The glue stock obtained is just as valuable as from limed or sweated hides, but should be limed before it is used.

The unequal thickness of horse-hides makes them particularly difficult to unhair and swell sufficiently for splitting, and to overcome this a depilatory liquor of eighteen degrees Bé. may be used on the fore part, and a liquor of twenty-four degrees upon the hind part, used either clear or mixed with lime. After unhairing, the hides may be limed for a few days in weak clean limes, the length of time of liming being reduced fully one-half. The subsequent treatment is the same as usually employed. Hog and alligator-skins are limed and treated in the same manner as horse and other hides. Patented depilatories are made and sold by Messrs. Stone, Timlow & Co., of New York City.

*An interesting process for preparing hides and skins
for tanning,*

Invented and patented by the Messrs. John and Edward Pullman, of London, England, is based upon the use of solutions of caustic soda and calcium chloride, in place of lime. This process is intended to do away with the old liming process. It consists of two baths. In the first bath the hides or skins are saturated with caustic soda. This is acted upon by calcium chloride of the second bath, and the union of the two chemicals forms calcium hydrate or lime, and salt in the interior of the hides or skins. The time of

preparing the hides or skins is greatly shortened, it being possible to accomplish in four hours what by the old method required ten days. More exact liming is obtained because definite weights of raw skins may be acted upon by previously-determined quantities of caustic soda and calcium chloride. The salts formed in the skins are very soluble and readily removed; and as a consequence less bating and drenching are required than in the older method of liming. The process may be reversed by first using the bath of calcium chloride and then applying to the skins saturated with the same, the caustic soda solution.

The hides or skins to be treated by this process must first be soaked in a putrid or foul soak. The object of this is to introduce a sort of bacterial action necessary to loosen the hair. After the skins or hides become thoroughly softened in the soak water, they are placed in a drum with a solution of caustic soda, from one to one and one-fourth per cent. of the soda being used. In this solution the stock is treated in the drum for three hours, more or less, according to thickness, and then taken from the drum and allowed to drain for some time, after which it is replaced in the drum with a one and a half per cent. solution of calcium chloride, in which it is drummed for from one-half to one hour.

When vats are used, more time is consumed than when drums are employed. The first bath usually requires forty-eight hours; and the hides or skins are handled two or three times. In the second bath they remain a similar length of time and are also handled once or twice. The unhairing is done in the usual way. The addition of a small quantity of sulphide of sodium to the caustic soda solution causes quicker loosening of the hair. In the case of skins upon which the lime or caustic alkali in solution possesses a deleterious action, the skins may be submitted to the action of a sufficiently strong solution of the calcium chloride until they are saturated with it, and they may then be painted upon the flesh side with the caustic solution, so that

by penetration into the skins a perfect and intimate liming results without contact with or injury to the fur, hair or wool. This method is necessary in preparing sheep pelts for pulling. When this form of treatment is employed, the strength of the calcium chloride may be about two per cent. and the strength of the caustic soda solution from three-fourths to one per cent.

A mixture of sulphide of sodium and chalk or whiting has been proposed for use in unhairing

Skins and preparing them for tanning. The composition may consist of sulphide of sodium, three parts by weight; chalk or whiting, one part; and water in quantity of eight gallons, more or less. The sulphide of sodium, in quantity about three ordinary bucketfuls, is first dissolved in water to obtain a solution of a strength varying from two to six degrees, Baumé test, the strength varying according to the nature of the hides or skins being treated. The demulcent, chalk or whiting is mixed with water, in quantity about eight gallons to one bucketful of chalk. This mixture is then added to the previously-prepared sodium sulphide solution. The solution with the demulcent in suspension is then introduced into an open vat or vessel provided with means for agitating the same, as for instance a paddle vat.

The hides or skins are introduced into the solution, which is thoroughly agitated for two or three hours. The hides or skins are then permitted to remain at rest in the solution for a comparatively long period, say ten to twelve hours, when the solution is again agitated. During the second agitation the solution is gradually diluted by the addition of fresh water until it contains no matter in solution or suspension, but is substantially free from the same.

By mixing with the sulphide of sodium a demulcent such as chalk or whiting, a liquid compound is provided, in the use of which the caustic nature of the sulphide is diminished and made far less energetic in its action upon the raw

hides or skins. By reason of its mild chemical action, the liquor readily softens the gristle, swells the fibre, as well as effects speedy dissolution of such animal matter as it is desirable to remove. Skins treated according to this process are said to be ready for tanning without further manipulation or treatment, and when tanned have fine, smooth grain and firm, plump and mellow feel. Patented by H. Holmes, Philadelphia, Pa.

The following described process is known as the Pierson and Moor process,

And is also a patented one. As will be seen by the description, it is new and useful for the purpose of treating skins and preparing them for leather. By this method of treatment, which is simple, expeditious and comparatively inexpensive, the skins of goats and kangaroos, and those of sheep from which the wool has been pulled, pelts and other skins and hides in the hair or raw condition, may be prepared for and delivered to the tanner in a few hours after the process has been commenced. In carrying out the process, a hot solution of sulphide of sodium is prepared. For example, twenty-five pounds of sulphide of sodium are placed in a tank or other suitable vessel and water introduced at a temperature of one hundred degrees. The resulting hot solution of sulphide of sodium is put into a drum that may be closely sealed and rotated and more water added, say twenty ordinary pailfuls or forty to fifty gallons. Into this solution in the drum the hides or skins, just as they come from the soaking process, or in the case of sheep-skins after the wool has been removed, are placed. The proportions of sulphide of sodium and water mentioned are enough for twenty dozen skins. This number of skins are placed in a drum with the solution of sulphide of sodium, the drum securely closed and the skins drummed therein for two hours. The drum, still closed, may now be permitted to remain at rest for ten or twelve hours, or over

night. During this time the skins are excluded from the air and are exposed to the solution of sulphide of sodium and to such fumes as arise therefrom. At the end of the stated time the drum is opened and the skins are washed with water, after which they are in condition for the tanner to receive and to tan them by any method of tanning. The skins treated in this manner will be found to be of close firm body, plump and with a fine smooth grain. In some tannages they do not tan so readily as skins prepared in the regular manner, but this can be overcome by the use of strong tanning liquors. The caustic nature of the sulphide of sodium has a more energetic effect upon some skins than upon others. Calf-skins are readily drawn or contracted upon the grain when they are treated to strong solutions of sulphide of sodium. A small quantity of lime mixed with the sulphide liquor assists in getting a smooth fine grain, and to overcome to some extent the drawing tendency of the sulphide of sodium liquor. When this method of preparing skins is used the hair is lost, but this loss of hair is made up by the firm solid leather that results. When a soft leather is wanted, the treatment with sulphide of sodium must be followed with a short liming.

CHAPTER XIII.

PATENTED PROCESSES OF BATING.

THE following process of bating hides and skins and swelling them is of German origin, and has been patented in all the countries of Europe, as well as in the United States. According to the specifications, it would seem that the rational method of neutralizing lime in hides and skins would be by the use of acids, sulphuric acid and others. Yet in practice it has been found that free sulphuric acid is not a suitable means of liberating the lime from hides and skins on account of its caustic properties. It has been found, however, that the sulfonic acids of the cresols, all of which form soluble lime salts, may be employed in tanning as a bate for freeing the hides and skins from lime, first because in these acids the caustic properties of the free sulphuric acid are neutralized, and also because they possess more or less antiseptic and albumen coagulating properties, thus preserving the skins before and during tanning. A solution of cresol sulfonic acid with water in the proportions of one to five hundred is advantageously employed. Into this solution the skins are placed at a temperature of about ninety degrees Fah. and allowed to remain from one to two hours, according to their weight, the solution being agitated by suitable means during this time. After this operation all lime will be found to have been extracted from the skins. When freeing skins from lime which possess their full amount of it, a mixture of the cresol sulfonic acid with varying quantities of free sulphuric acid can be advantageously employed. The free sulphuric acid will act first upon the lime upon the surface or upper layer of the skin so as to form gypsum; and this

is afterwards rinsed off the skin by the subsequent treatment. Not until this neutralization of the free sulphuric acid has taken place will the sulfonic acid be able to act on the lime in the lower layer of the skins so as to entirely dissolve the same. After the skin or hide has been freed from the lime, the swelling process may take place in a fresh solution of sulfonic acid and water in the proportions of one to five hundred, which is necessary for the purpose of preparing sole-leather. As the sulfonic acids, on account of their marked properties of coagulating albumen, exert no dissolving effect on the substance of the hides or skins themselves, this treatment gives a very favorable result in respect of weight. Owing to the entire removal of the lime from the body of the skins, and owing to the sterilizing and hardening of the tissues which take place during the operation, the leather obtained attains great strength and has a soft grain and light color.

The cresol sulfonic acids are obtained in great quantities as by-products in the manufacture of carbolic acid. By treating them with sulphuric acid they are readily changed into acids that have proven themselves excellent materials for neutralizing lime in hides and skins.

The bate is obtained directly from crude cresol by mixing a given quantity of the same with two or three times the quantity of sulphuric acid and heating the mixture for several days in the water-bath and then adding sufficient water and allowing it to stand until the gummy impurities are separated and the pure solution obtained. The anti-septic property of cresol sulfonic acid is so considerable that the bating liquor may be permitted to stand for several weeks without deteriorating in quality or decomposing. For this reason the same liquor can be used by addition of new quantities of cresol sulfonic acid for a number of operations. The bating liquor has only then to be replaced by an entirely new liquor when impurities in considerable quantities are collected in the same.

With the same results the waste products of the manufacture of carbolic acid can be used, as these consist mainly of cresols, and the so-called crude carbolic acid can also be used.

After the removal of the lime and cleaning the hides, it is necessary to produce the swelling of the same, which is obtained by placing the hides in a liquor formed in the proportion of one to one thousand of a cresol sulfonic acid in water and leaving the hides for about twenty-four hours in this liquor; but even if the hides remained longer in the swelling liquor they would not be injured. The swelling of the hides can be accomplished with a solution of sulfonic acid which is entirely free from or which is mixed with a small quantity of free sulphuric acid.

Generally speaking, the proportion of free sulphuric acid to the sulfonic acid solution has to be adapted to the nature of the skins, and to the purpose for which they are to be used.

Patented by W. Dieterle, Feuerbach, Germany.

A process of bating

By which the objects aimed at are accomplished by the use of a compound solution of sulphuric acid, borax and glauber salt has also been made the subject of a patent. In applying this process, the hides or skins, after liming, are placed in a vat or other suitable apparatus containing a solution of three pounds of sulphuric acid, three pounds of borax and three pounds of glauber salt, these ingredients being thoroughly mixed with about five or six barrels of water, or sufficient water to cover one hundred and fifty hides or skins. After being placed in this solution, if they are not agitated in any manner, the hides or skins should remain in the solution about thirty-six hours, but if the solution and the hides or skins are in a tank provided with a wheel for stirring, then about five hours will be sufficient for the action of the solution.

After the treatment of the hides in the solution above

described, they are then placed for a second treatment in an ordinary bark liquor, to which are added about three pounds of muriatic acid, and about fifty pounds of common salt. The quantity of bark liquor to which the above ingredients are added is about one thousand gallons of six degrees Bé. The addition of the muriatic acid and salt to the bark liquor serves to precipitate all foreign substances in the liquor, and to prevent any fermentation thereof, and the action of the ingredients in the solution so formed is to soften and render the hides soaked therein more plump.

This method of treatment of the hides in a solution of water, sulphuric acid, borax and glauber salt for neutralizing the lime in the hides may be practiced without treating them to the solution of bark liquor, muriatic acid and salt; and also the hides may be treated to the action of the latter solution without submitting them to the action of the first named liquor for the purpose of neutralizing the lime. N. Wilson, Becket, Mass., has patented the above process.

✓ *Bating with potatoes and yeast.*

Among the various methods recommended by those who have made the process of bating and preparing the skins for tanning a special study is a process by which the bating, drenching and cleansing of the stock are accomplished by the use of a bath of potatoes and yeast. This method of bating depends also for its efficacy upon the fermentation that is developed. It is very cleanly and free from all obnoxious odor. In using this method of bating and drenching the skins are removed from the liming process and unhaired, fleshed and washed in warm water in the usual way. The bath to which they are subjected is made up of potatoes and yeast. A sufficient quantity of potatoes are boiled until they are soft, and are then mashed fine, after which they are stirred into warm water. The skins are placed in the mixture and as much yeast as may be

necessary is added, the proper ratio being about one quart of yeast and one bushel of potatoes in two hundred and fifty gallons of water to five hundred skins. The fermentation is allowed to take place while the skins are being treated. The length of time consumed by the process is about twelve hours, and at the end of this time the skins will be ready for slating. After being slated, the skins are placed in the same bath and kept therein for another twelve hours, being thus brought into proper condition for tanning. By this method of treatment the skins are made soft, tough and elastic and are free from all odor. This treatment also renders the usual treatment with bran unnecessary; the fine hairs are readily removed and all the lime is drawn from the pores, leaving the skins clean and soft. Patented by William Oetlingler, Philadelphia, Pa.

Another prepared bate

That has been used successfully in practice is the Norris New Solid Bate. This bate depends for its efficacy upon the fermentation developed. One pound of this bate is sufficient for a pack of hides, forty-two seventy pound hides, seventy thirty-five pound hides or thirty ninety pound hides, one hundred nine pound calf-skins or two hundred and forty sheep-skins. It is used in this manner: Take a clean barrel, remove the head and place in close proximity to bate vats. From the package shave with a knife the desired quantity into a pailful of warm water. Stir until dissolved. Pour this into the barrel, which has been filled about half full of warm water, stir well and allow it to stand at least twenty-four hours. Dip out nearly all the contents of the barrel and pour into the warm water of the bating vat, stir well and put in the hides or skins which have been washed after unhairing. When the hides or skins are removed from the bating vat, nearly all but not quite all of the old liquor should be run off. For the first pack use double the regular quantity of bate. All bates

work best in pools or tubs in which there is a wheel. Many puresmen do not run off the liquor, but freshen it up from day to day with new bate. If this is done, the contents of the bating vat should be well stirred up and about one-third drawn off every day and warm water and fresh bate added. In this way the same solution can be used for several weeks.

As it is sometimes difficult to obtain the best results with the first pack, it is well to dissolve a package of bate in a half barrel of water (90°) and let it stand in a warm place about a week before using. Stock which has been unhaired by sulphide of sodium or red arsenic, used in connection with lime, should be very thoroughly washed before going into the bate. A small quantity of sal ammoniac, one-half pound for one hundred pounds of stock, can be advantageously added to the water in which such stock is washed previous to bating. New Solid Bate is made and sold by W. N. Norris, Princeton, N. J.

Bating with naphthaline sulphuric acids.

In this process of bating, there are employed in the treatment of hides or skins, as a means of accomplishing the neutralization of the lime and alkali sulphides used in depilating, the sulphonic acids of naphthaline. The hides or skins are immersed in a warm or cold solution of the acid of sufficient strength or of more than sufficient strength for the conversion of the alkali into its salts. The length of time the hides or skins are subjected to the action of the acid varies with different kinds of stock. For best results it is desirable to use the acid as pure as possible; but good results may be obtained even if the acid contains some of the impurities incident to its manufacture, such as free sulphuric or muriatic acid and salts of both, together with traces of the naphthaline sulphuric acid salts or traces of metals arising from the apparatus in which the acid is made.

The naphthaline sulphuric acids are best employed in a

solution varying from two to five per cent. in strength, although it may be used very much weaker or stronger. If weaker, its action is much slower, and there is very little necessity for making it any stronger, the object being to use an excess of from two to four per cent. over the amount necessary to convert the alkali used as a depilatory and contained in the hides or skins at the time of treatment, with its naphthaline sulphonie acid salts.

The advantages resulting from the use of the naphthaline sulfonic acids may be briefly stated as follows: Their marked antiseptic qualities which preserve the hides or skins from dissolution or loss during the bating process; the avoidance of the introduction of bacteria into the tan solution or liquors which is attendant upon common methods and upon the use of acids that induce decomposition; their lack of action upon the hide structure itself, except as a preservative; the extreme solubility of their salts; their lack of action with iron salts to produce a discoloration of the solution; by the complete removal of the alkali or alkaline salts used as a depilatory; its action upon the hides or skins fitting them for rapid combination with the tanning agent and effecting in the leather the lightest color of which the hides or skins are capable of assuming with the tanning agent used, and the production of the greatest weight of leather of which the hides or skins are capable through the avoidance of loss of gelatine. This process was patented in 1891 by Messrs. C. S. Hull and P. S. Burns, of Boston, Mass.

The use of a coal tar bate

Preserves the natural enamel on the grain of the hides and skins, so often destroyed by fermenting bates, and has, besides, a bleaching effect on bark tannages, imparting a much lighter color than would be otherwise obtained. It is very simple and economical to use. The skins are removed from the limes and unhaired and fleshed and thoroughly washed

with water at a temperature of ninety degrees or thereabouts, so as to remove as much of the lime as possible. If, during the process of liming, sulphide of sodium is used in combination with the lime, it renders the lime more soluble and therefore more easily removed with water. The object of washing the skins is to cleanse them and to partially bate them, thereby effecting a saving in the quantity of bate required. After washing, the skins should be thoroughly worked on the beam, especially on the grain.

The bating solution is prepared in the proportion of from one-half to one pound of bate in one hundred gallons of warm water. The bate should be dissolved in a pail of hot water of a temperature of one hundred and forty degrees. Under no circumstances should it be boiled. If the hides or skins have been treated as above suggested, one pound of bate should be sufficient for four hundred pounds of wet hide, washed from the limes. The hides or skins are placed in the bating solution and stirred about for an hour. They are then allowed to rest in the liquor with occasional stirring for some hours or over night.

The length of time that the bating should continue depends upon the degree of softness wanted in the leather. For example, for sole leather fifteen minutes is sufficient; for satin leather thirty minutes; for glove leather four to six hours, or even longer.

On removing the skins from the bating solution it is sometimes desirable for the finer grades of leather to wash them in water and again work them over the beam. They are then ready to be placed in the tanning liquors. In preparing the bating solution for the second pack, one-third of the old liquor should be drawn off and replaced with fresh water; then one-half the quantity of bate used at first should be added, and this repeated for each succeeding pack.

When fresh white limes are used toward the end of the liming process and a manure bate is deemed necessary to

reduce the harshness of the grain caused by the fresh lime, it is very beneficial to give the skins from the manure bate a drench of coal tar bate, thereby arresting the bacterial action of the manure bate, preserving the grain, besides cleansing, bleaching and neutralizing the skins preparatory to tanning them. Again, when it is considered desirable to use a manure bate, it is good practice to treat the skins first in a solution of the coal tar bate and then place them in the manure bate. By this method of treatment the destructive action of the manure bate is arrested and the risk of damage to the grain lessened. In all cases where the value of the leather is dependent on the quality and perfection of the grain, this is an important advantage to gain. Coal Tar Bate is made and sold by The Martin Dennis Chrome Tannage Co., Newark, N. J.

An interesting patented process of bating

Is the invention of Charles W. Koch, of Milwaukee. After the hides or skins have been thoroughly washed and as much of the lime removed from them as is possible, a further treatment is necessary in order to more completely prepare the hides or skins for tanning and to produce a superior leather. To accomplish this object in a simple manner and without injury to the hides or skins a solution of about two hundred and fifty gallons of water, one hundred and fifty pounds of common salt, three pounds of hyposulphite of soda and three pounds of either sulphuric or muriatic acid is used. About two hundred calf-skins and about fifty hides can be agitated in this solution for about two hours. After this they are processed in a second solution composed of two hundred gallons of water, ten pounds of glauber salt and sixty pounds of hyposulphite of soda or the same quantity of sodium sulphite crystals. In this solution they should be stirred about for two hours or longer, after which they are ready for the process of tanning. The above solutions can be used for a long time, as they do not ferment or de-

compose. They only require strengthening proportionately, as they become weakened, by the addition of the same ingredients. The ingredients of both solutions can be combined in one with good results.

For the purpose of neutralizing lime in hides, skins and glue stock, carbonic acid gas has been suggested

And a patent taken out on the process. This process may be applied to hides and skins intended to be tanned into leather, but it is really intended by the inventor to apply it to glue stock. The lime contained in hides and skins and glue stock is generally neutralized by subjecting them for some time to the action of the atmosphere, the neutralizing of the lime being accomplished by the carbonic acid gas contained therein. This method of treatment is slow and imperfect. The use of carbonic acid gas, to which hides and skins are subjected, is said to produce more or less satisfactory results. It has been discovered that the caustic lime contained in hides, skins and other animal tissue may be quickly and thoroughly neutralized by subjecting them while in water to the action of carbonic acid gas. The more thoroughly the hides and skins are agitated in the water to which the carbonic acid gas is introduced, the shorter will be the time necessary for the neutralization of the caustic lime contained therein, and the more thoroughly and perfectly will the process be carried out.

In carrying out this process the necessary agitation of the bath may be produced in two ways, first by forcing a jet or jets of carbonic acid gas into the water in which the hides or skins are contained, at such pressure as to cause an active agitation of the mass and the consequent exposure of every part of the materials treated to the gas and to the bath of acidulated water; and secondly, by providing the vessel in which the hides or skins are treated with mechanical stirrers, by which the water and the hides or skins contained therein are kept in a state of agitation during the

admission thereto of a jet or jets of carbonic acid gas. The chemical action consequent upon the treatment of the caustic lime in the skins with carbonic acid gas results in the formation of inert carbonate of lime. Various mechanical devices may be employed to carry out this invention. The inventor of this process, Chas. W. Cooper, of Brooklyn, New York, has also invented a form of apparatus to be used in applying the process. By the use of the apparatus better results are obtained than by any other means. However, it has been found possible and practicable to neutralize the caustic lime contained in the substances treated by introducing a sufficient volume of carbonic acid gas to a vessel containing water and skins to actively agitate the mass. The essential feature of this invention is the treatment of hides, skins or other animal substances containing lime in water, with carbonic acid gas, whereby a proper distribution of the gas and its application and contact for a sufficient time to and with every part of the material are insured, and the neutralization of the lime quickly and thoroughly obtained.

A process of bating in which bichromate of potash is used

Has been made the subject of a patent by Henry Schlegel, of Lapeer, Mich. In practical work this bath is used in the following manner: After unhairing, the hides are washed in a wash-wheel, then a vat is filled with the quantity of water required, after which the bate-wheel is started up, and with a steam ejector the liquor is warmed up to 80 degrees Fah. The ejector is fixed so that the hides cannot get near the end of suction or discharge pipe, and while the water is getting warm the necessary amount of bate is dissolved in hot water and poured into the bate vat. After the bate has been put in, the hides are run in the liquor for a short time and then left in the same, over night or longer, depending upon their condition. Then they are fine-haired, again washed in warm water and are ready for

tanning. About two ounces of the bate are used for two thousand pounds of green salted hides or skins.

The gist of this process lies in the employment of a chromium compound as a base. The chromium compound mixes with the lime and causes the same to be readily washed out.

CHAPTER XIV.

THE MANUFACTURE OF CALF-SKIN LEATHER.

BEAM-HOUSE PROCESSES.

CALF-SKINS are tanned into leather and finished in various ways. Large numbers are made into chrome leather and finished in smooth and boarded, black and colored. In addition to the chrome processes, different vegetable processes are used. Gambier and similar soft tannages are frequently used. Leather tanned by any of these methods is finished upon the grain. Wax calf and satin leather are finished upon the flesh or inner side. Skins that are imperfect upon the grain by reason of scratches and breaks are worked very satisfactorily into wax leather, the quality of the grain in this class of leather counting for nothing. Calf-skins are also made into glove leather, also into leather for lining purposes and into fancy leather. For glove-leather chrome, oil, napa and other soft tannages are used, while upon skins intended for special and fancy leather, vegetable processes are used. Of all skins, calf-skins are the most difficult to tan. This is because they have not attained maturity and full strength of fibre. They require very careful handling, being very easily injured by carelessness or abuse. The details of the process must be watched and carefully carried out. Many imperfections met with on finished calf-skins are the direct result of ignorance, carelessness or abuse in some part of the work. To meet with success in the making of calf leather requires much skill and judgment, and these are only acquired by application, study and experience.

During the processes of preparing the skins for tanning,

much of the quality of the finished leather is decided by the methods and materials used in these processes.

Grading and Classification of Green Calf-Skins.

Green calf-skins are graded and classified in the following manner by one of the largest calf-skin dealers in this country. They are first graded as to qualities, viz.:

First, drawn or fisted off. These are skins that are perfect in every respect, fresh, clean, free from scars and other imperfections and in choice condition. No deep scars are allowed on the bodies of these skins, although slight knife marks are permissible. If the hair slips on a spot no larger than a silver quarter dollar, the skin drops down into a No. 2.

Second, regular No. 1. These are clean, fresh skins that have been properly taken off with knives. Scores are allowed in this grade, but there must be no holes, hair slips or other bad imperfections. An old salt-stained skin, even though it has no holes nor hair slips, is not allowed in this grade, but is put into No. 2.

Third, good No. 2. This term designates those skins that are slightly hair slipped. In this grade are also included those skins that have one, but not more than one hole in the body of the skin, and all old or salt-stained skins, even though they have neither holes nor hair slips.

Fourth, proof No. 2. This class of skins are those that have more than one and less than five holes in them; also those that are badly hair-slipped or otherwise badly injured.

Fifth, culls. A cull is a skin that has five holes or more in the body of the skin, or one badly damaged by reason of moths, ticks, taint or other serious imperfections.

There is another still lower grade of skins, which is called "glues." These skins are practically worthless for purposes of tanning into leather, and are always bought and sold on terms agreed upon according to their valuation.

After the skins are graded according to quality, they are subdivided to weights, viz.:

First, what are known as deacon or dairy skins. These are skins taken from calves whose meat is not used for food. They weigh in the green untrimmed condition below seven and one-half pounds. This classification also includes trimmed veal skins weighing under five pounds.

Second, five to seven pound trimmed veal skins. This classification also includes a deacon or dairy skin weighing, green and untrimmed, seven and one-half pounds and above.

Third, seven to nine pound veal skins.

Fourth, nine to twelve pound veal skins.

Fifth, twelve to seventeen pound veal kip.

Sixth, kips weighing from seventeen pounds up.

These are the grades and classifications into which the skins are sorted when they are received at the warehouse of the dealer. Skins are sold in these grades to tanners, although all dealers do not strictly follow these classifications. When skins are carefully graded as to quality and weight, and the characteristics of each grade are well known to the tanner, he can buy the class of skins that is especially adapted to his particular needs.

Slunks are skins taken from still-born calves. They are very light and tender skins, and have a very fine clear grain. They are usually sold by the piece, the price per skin being determined by the quality of the skins.

Large numbers of calf-skins are imported into the United States from foreign countries in both green salted and dry condition. The green salted skins are used for the same classes of leather as domestic skins, while many of the dried skins, owing to many scratches and breaks in the grain, are valueless for leather finished upon the grain, and must be worked into wax and similar leathers.

Soaking Process.

During the soaking process it is necessary that all the salt, dirt and other objectionable substances be gotten rid of, as this has much to do with bright, clear-grained leather.

Then, too, it is advisable to accomplish these results in as short a time as possible, and not to carry the soaking beyond a certain point. Soaking for a long time results in loose and lifeless leather, lacking in fullness and plumpness, owing to the loss of gelatine which it is important should be left in the skins. In order to accomplish clean, rapid and thorough soaking the salted skins should be soaked in clean, fresh water. When they are heavily salted or very dirty, a good practice is to soak the skins for a few hours in clean water, then to withdraw them from the vat, and after allowing them to drain until the dirty salty water is drained off, to soak them a few hours longer in clean water. Ordinarily no change of water is required, if clean water is used. The length of time consumed by the soaking process depends upon the thickness and condition of the skins, and no arbitrary rule can be followed nor is it necessary. Ordinary salted skins can be soaked in ten hours. They may be soaked longer though without injury, say from twelve to fifteen hours, and some tanners soak these skins for twenty-four hours.

While the salt used upon the raw skin acts as a preservative, upon becoming dissolved in the water it has an injurious effect upon the stock, frequently causing the leather to be soft and lacking in fullness, and at the same time to show a clouded and streaked grain. Old stale soaks in which large quantities of dirt, blood and salt have become dissolved are risky and unpleasant to use, clean, fresh soaks producing the best results. The putrefaction which frequently sets in, in old soaks, sometimes affects the skins in such a manner as to impair their quality, although many times the condition is not noticed at the time, and later no one can tell what caused it. It is not best to put a mixed lot of skins into the soaking process. In other words the skins should be sorted and only those of like nature and size soaked together. This is a good rule to follow in all leather-making processes, the sorting of the skins before

putting them through any process, assisting greatly in getting uniform results.

A good method of soaking salted skins

Is to wash them for a few minutes, and then to put them into the soak water for a number of hours, ranging from ten to twenty-four, according to their thickness and condition. Dried calfskins of course require longer and more thorough soaking in order to get them soft enough to go into the liming process. Such skins when carefully handled result in very nice leather, although the grain is more or less afflicted with cracks and other imperfections. Sulphide of sodium may be added to the water in which dry skins are soaked, in quantity sufficient to enable the skins to become soft in from thirty-six to forty-eight hours. After the skins have become partially softened they may be removed from the water, worked mechanically and then resoaked until they are thoroughly softened. It is not advisable to pass these skins along into the unhairing process until they have become soft and clean. Both green and dry skins after soaking should be drained, and the dirty water allowed to run off before they are unhaired. They must be kept from heating, as heating even in a slight degree results in more or less injury to the skins, which no subsequent treatment can remedy or cure.

Borax also produces good results when it is used in the soaking process. When sulphide of sodium is used from one-sixteenth to one-eighth of an ounce is enough for each skin, dissolved in warm water and poured into the water in the soak vats. When borax is used from three to five pounds may be dissolved and added to each one thousand gallons of water. The borax helps in getting a smooth soft grain, and at the same time keeps the soak water fresh and sweet. Fresh water should be used for every pack of skins, as when this is done, bright, clear leather results, although many tanners use soaks over and over until they become stale and foul.

In the preparation of calfskins for any chrome process, the essential thing to be accomplished is the keeping of the substance of the skins intact, so as to result in plump leather. To soak the skins for too long a time or to lime them too long results in soft, thin and lifeless leather. As there are little plumping or filling qualities in chrome processes it is especially important that the loss of skin substance be guarded against; more so for this class of tanning than for any other.

A popular process of preparing calfskins for tanning by chrome methods,

Removal of the hair and swelling of the skin-fibres, is by the use of arsenic limes. This method of depilating and preparing the skins results in soft and elastic leather, fairly plump and with a fine, smooth grain. After the skins come from the soaks and are drained, they are, by some tanners, fastened into a long chain, and entered into the liming process, and by the aid of the reels passed from one lime vat to another. Much labor of handling the skins is saved in this way. The best results follow when the skins are started in a weak lime liquor and this liquor strengthened each day until it becomes strong or the skins are passed into stronger lime liquors each day. When the skins are limed too rapidly the grain often becomes loose from the flesh, the strength of the leather impoverished and trouble met with in the processes of tanning and finishing. When an old lime liquor is to be had, the strength at the beginning should be about 5° Twaddle. Into this lime the skins are placed and allowed to remain therein for a few days until they become thoroughly impregnated with the liquor, then the strength of the liquor should be increased or else the skins hauled out, drained off, and entered into a stronger lime. By this way of preparing the skins, they are made soft and pliable, the fine hairs readily come out and the grain is not injured. Calfskins should be left in a strong lime as short a time as possible.

Preparing the Limes.

The rules followed in preparing the limes vary. Many tanners follow no rule, but work according to judgment, relying solely upon it to tell them when the skins are limed enough. When old lime liquors are to be had, a good starting lime may be prepared by using two-thirds old liquor and one-third new, that is of six hundred gallons in the vat four hundred gallons are old lime liquor and two hundred are new and fresh liquor. This may be strengthened each day by the addition of new lime and arsenic, or the skins, after being in this weak liquor for two or three days, may be passed into stronger limes until they are sufficiently swollen to enable the workman readily to remove the hair. In preparing a new lime about one hundred pounds of lime are slacked with about twelve pails of hot water. To this quantity of lime from five to ten pounds of red arsenic are added. The arsenic should be dissolved separately and then added to the slacked lime. Both materials need to be thoroughly dissolved before coming in contact with the skins. The quantities of arsenic and lime mentioned are enough for six hundred calfskins to begin with. After the skins have been in the liquor one day they should be hauled out and the lime well stirred up from the bottom of the vat. If the skins are allowed to drain before going back into the lime they will take up the lime more readily. When paddle vats are used the hauling out is not necessary, although it is a good plan to keep the lime stirred up from the bottom of the vat. On the third day the lime should be strengthened by the addition of fresh lime and arsenic. If the strength for the first day or two should prove too strong and the grain show any injury, less lime should be used for the next lot of skins. Considerable judgment is necessary in preparing calfskins, as they are young and tender skins and need to be handled carefully. It is wise to strengthen the lime liquor each day by the addition of two or three pails of slacked lime, until the hair becomes loosened, and

after the hair starts it is wise to let the skins lie in the liquor for two or three days longer, as this not only causes the hair to come off more readily and cleanly but makes the leather softer. The liming will be accomplished in about five days, if paddle vats are used, but this must be left to the judgment of the workman. When the skins are left two or three days in an old weak liquor, five days in a strong liquor are generally sufficient, although much depends upon the thickness of the skins, temperature of the limes and the time of the year. Less time is required in the summer than in the winter. It is not good practice to lime the skins from the start in strong limes. The better way is to allow the skins to lie for a day or two in an old weak liquor and when they have become thoroughly impregnated with the solution to place them in the strong limes, for five or six days. In this way the grain is left smooth and fine and the fibres are not loosened. The removal of the hair may be done by hand or machinery, after which the skins are washed, slated on the machine and the grain cleaned, and are then ready for the bating and drenching.

Sulphide of sodium is used in much the same manner as the red arsenic.

It is mixed with the lime either before or after slacking, and forms with the lime a very satisfactory process by the use of which the time of liming is considerably shortened, the grain kept smooth and the lime made more soluble and therefore more easily removed before tanning. A very common method of using sulphide of sodium is to mix it with the lime in the same manner as described for red arsenic. Usually about one-half as much sulphide of sodium as of lime is used, and the skins entered into a weak lime, left therein one day, pulled out and the lime strengthened. This is repeated for six or eight days, when, according to the thickness of the skins and the strength of

the liquor, the skins will be sufficiently swollen to enable the tanner readily to remove the hair.

The sulphide of sodium may also be used in other ways

With good results. One of these ways is to prepare a solution of lime and sulphide of sodium in a vat, using about twice as much sulphide of sodium as lime. The strength may range from two to five degrees Béaume. Into this liquor the skins are placed and stirred about occasionally. At the end of the first day the strength may be increased by adding more lime and sulphide, and at the end of two or three days the hair will be dissolved and the skins can then be washed, and limed for about four days longer. When it is desired to save the hair and at the same time prepare the skins in a very short time, they may be painted upon the flesh side with a solution of sulphide of sodium and lime. This procedure produces good results, although it is not in general use. About one-half barrel of lime may be used to fifty gallons of water. The lime should be completely reduced to milk of lime with hot water and thoroughly stirred from the time the lime and water are put together until all the lime is dissolved. No particles of unslaked lime should be left in the mixture. The solution should be allowed to cool and used at the consistency of thin paste. About six pails of this lime should be mixed with a barrel of sulphide of sodium liquor of a strength of eighteen degrees Bé. After the skins have been soaked they should be well drained, then spread upon a smooth surface and the mixture of lime and sulphide of sodium applied to the flesh side with a vegetable brush. Enough of the liquor should be put on to cover the skins without running off. After treatment the skins are folded once and placed in piles until the next day. The skins swell very rapidly, and usually the hair starts in a few hours. However, it is best not to unhair the skins until the next day, when the hair can be readily removed with a dull instrument or stick. After unhairing the skins should

be immersed in cold water, in which they will be kept from drying and spoiling. A liming in clean rather weak limes for from four to six days will finish the process, and the skins may then be bated or drenched and tanned. This method of treating the skins requires more labor than the others that have been described, but results in good plump leather, and if the hair is to be saved it may be washed and spread out and dried. The skins must not be allowed to heat in summer and not to freeze in winter. Whenever the hair comes off with difficulty the skin should be repainted, so as to avoid straining the grain. After the hair has been removed, the skins require further swelling, which the liming accomplishes. The first lime into which the skins are placed may be liquor that has been used before, and if it is rather strong, about one-half of the liquor may be run out and replaced with water, or a lime may be made new by putting about two buckets of lime into the required quantity of water for two to three hundred skins, according to their size. The skins may be left in this lime from one day until the next, and then if still vats are used, they should be hauled out and two more buckets of lime added. On the third day more lime should be added, and in from four to six days the skins will be prepared for bating. The thickness of the skins has much to do with the time required to lime them, and also the degree of softness wanted in the leather. Skins intended for a one-bath process of tanning usually require a trifle more lime than skins to be tanned in acid baths, as the latter split up the fibres of the skins, which the one-bath processes do not do.

BATING PROCESSES AS APPLIED TO CALFSKINS.

The bran drench has been in use for a great many years, and while it is somewhat uncertain and unpleasant to use, it is to be preferred to manure purging or bating. It is used by many tanners of calfskins, and when properly used produces soft, clear skins that work into desirable leather.

The best bran to use is the finer grade, as it contains more flour than the coarse grades. A method of using the bran drench is carried out as follows: For a pack of skins ranging in number from three hundred to four hundred, one-half of a barrel of bran is mixed with enough water to make a thick mush. This is allowed to stand forty-eight hours, or until it becomes sour. Warm water hastens the souring. When the bran is thoroughly sour it is emptied into the water in the drenching vat. To the drench are added three pints of sulphuric acid and three pecks of common salt, and the entire mixture stirred together, and the temperature raised to ninety degrees. A paddling in this drench for from four to five hours is generally sufficient for light and medium weight skins, heavy skins requiring longer time. This drench reduces the skins to a very soft and slippery condition, and thoroughly cleanses them of all lime. The usual working or slating may be given the skins, after which they may be washed off in warm water and are ready for tanning. The important points to be observed in the use of the bran drench are that the fermentation is fully developed; that the skins are kept well opened out and constantly, or at least frequently, stirred about, and the temperature of the liquor no higher than ninety degrees.

As soon as the skins settle to the bottom and remain there they should be removed without delay, as to leave them in longer results in injury to the stock. When the bran is not allowed to thoroughly ferment before use, or the liquor is used too hot or for too long a time, the grain of the skins becomes rough and raised, and the stock thus seriously damaged. Considerable skill and judgment are required in handling the bran drench to get the right results, and when trouble is encountered, carelessness or ignorance is generally the cause. No matter what method of depilating and swelling the skins is used, after the process is completed the skins require to be thoroughly

fine-haired, and washed in warm water to accomplish the removal of much of the lime. The more thoroughly the skins are cleansed with warm water, the less bating and drenching are required. Soft, pliable leather cannot be made until the skins are properly prepared to receive the tannage, by being thoroughly washed, cleansed and reduced from their plump and swollen condition acquired during liming to one of softness and neutrality.

Very good results follow the use of lactic acid

Upon calf-skins intended for chrome tanning. This material readily dissolves the lime in the skins, and at the same time leaves them with considerable plumpness, two very important points in making chrome leather. After washing in warm water the skins are placed in a drench prepared as follows: One hundred gallons of water are heated to a temperature of from ninety to one hundred degrees Fah. To this is added one gallon of lactic acid. The quantity of acid necessary varies according to the condition of the skins. One gallon of acid to one hundred gallons of water is the maximum quantity. Much less may in many instances be used and still the right results be obtained. When the drench is warm, the lime is readily dissolved and the skins become soft and thin. In a cold drench they remain full and plump, although the lime becomes dissolved also. A paddle-vat should be used for this process, and the skins stirred about constantly. After being in the liquor for two hours the skins will be sufficiently drenched to receive the usual beam-work or slating. Calfskins treated with lactic acid stand much more working than those treated by any other process of drenching. After the slating or the beam-work the skins should be put back into another drench somewhat weaker than the first, say two quarts of acid in one hundred gallons of water, and stirred about therein for one hour in order to further cleanse them, and to remove any dirt acquired during the beam-work or slat-

ing. If the skins are to be pickled before they are tanned they may go at once into the pickle from the second drench without further washing, while if they are to be tanned in a two-bath process, and not pickled, they may be washed off in warm water and are then ready for the tanning process. When one pack of skins follows another, the drench liquor can be used over and over by being strengthened for each lot of skins, by adding one-half the quantity of acid first put in. This applies to the first drench. The second may be kept sufficiently strong with acid by the addition of less than one-half the first quantity put in, but this must be decided by the workman. Sometimes one lot of skins requires more acid than others, and the operator must use judgment. The use of more acid than is actually required will not injure the skins; it is merely wasted.

Drenching in a pin-mill drum.

While the paddle-vat method of drenching is the best that can be used, the skins can also be drenched in a pin-mill drum. When this is done one pound of acid is required for each one hundred pounds of skins, in enough warm water to enable the skins to drum nicely. The skins should not be drummed longer than from twenty to thirty minutes, removed from the drum, given the beam-work or slating, washed in another drench and are then ready for pickling, or if they are not to be pickled, they are washed after the second drenching and are then ready for tanning.

Advantages of lactic acid.

The use of lactic acid for this purpose is to be recommended, because it is safe, cleap and cleanly. There is no objectionable smell to the process or to the skins, no danger of injuring the leather and by using the liquor over and over by strengthening it up for each lot of skins great economy can be achieved. The drench is also readily prepared, requiring only a few moments, and after it is prepared and the skins put in no attention at all is required until the time

to remove the skins from the drench. These points all recommend lactic acid for deliming calfskins.

Another method of using bran

For deliming the skins, is to use about two hundred pounds of bran for each five hundred skins of medium size. The bran should be allowed to ferment before it is used, and to accomplish this it should be cooked or at least mixed with hot water, to which a cake of yeast or a small quantity of sulphuric acid has been added. A pailful of old sour liquor will also hasten the bran to turn sour. One-half of the bran is mixed in the required volume of water, stirred well and then one-half of the skins are put in, then the balance of the bran is added and the remaining skins. The skins should be put in as quickly as possible in order to have them get a uniform degree of heat. This is best accomplished by having the skins in piles along the edge of the vat, and several men detailed to do the work. The stirring of the drench is a matter of some importance, in order that all lumps of dough may be broken up. The bran sometimes forms lumps of dough which retain the heat, and when these break up in contact with the skins the heat causes small, hard burn-spots to appear, which are objectionable.

Calfskins intended for any chrome process require careful bating and drenching. It is important that the paddle-vats in which the process is carried out are sufficiently large to allow considerable floating and turning in the liquor. If the vat is too small for the lot of skins they will turn around in bunches and get unevenly drenched.

MANURE BATING.

When manures are used upon calfskins, the process is carried only to the point where the lime becomes thoroughly dissolved. Then the skins are taken from the manure pure or bated and drenched in a lactic acid bath for a short time

and they are then ready for tanning. The use of manures cannot be recommended, as they are dangerous and uncertain as well as unpleasant in the extreme. Some tanners, however, continue to use them in spite of their disagreeable features and the fact that their use can be dispensed with entirely and newer and better articles used in their place. A good method of using manures for bating is to leave the skins in the bate liquor simply long enough to dissolve the lime. If the process is carried further than this some of the substance of the skins becomes dissolved, and the leather lacks fullness and plumpness. A bating in a warm manure bath for two or three hours is generally sufficient to accomplish the object aimed at. Then the skins should be drenched in a warm bath of lactic acid, slated, washed off and are then ready for the process of tanning. The slating or working of the grain of the skins is an important part of the beamhouse work, as it removes all hair roots, dissolved lime and fine hairs. After the final washing the skins should be drained well and then weighed for tanning.

CHAPTER XV.

CALFSKINS AND CHROME PROCESSES.

CALFSKINS may be tanned with the two-bath acid process in two ways. For the first bath may be used ten pounds of salt for every hundred pounds of skins, dissolved in fifteen gallons of water. The skins may be drummed in this salt solution for fifteen minutes, and then may be added two pounds of muriatic acid for every hundred pounds of skins. This acid should be diluted with water and given gradually to the skins, and the drumming continued for fifteen minutes. The pickling in acid and salt serves to open and plump the skins and to keep them smooth during tanning. Before the chrome liquor is applied the acid liquor should be drained off. Then the following bath is prepared: Into twelve gallons of warm water dissolve two pounds of bichromate of potash for every hundred pounds of skins. This should be used cold and the skins drummed in the same for thirty minutes. Then the strength of the chrome bath may be increased by the addition of four pounds of bichromate of potash and two to three pounds of common salt, dissolved in fifteen gallons of water, for every one hundred pounds of skins. This liquor is given to the skins through the hollow gudgeon of the drum and the skins milled therein in three to four hours or until they are well penetrated with the yellow liquor and thoroughly seasoned with it. Then they are taken from the drum and thrown over horses and allowed to drain over night.

The skins can also be tanned by being drummed in the following solution for the first bath:

Twelve gallons of water to which are added in solution five

pounds of bichromate of potash and two and one-half pounds of muriatic acid. A few pounds of salt may also be added. The skins are taken after the final washing and without pickling are placed in the drum with this chrome solution and drummed in it for a sufficient length of time to enable the yellow liquor to penetrate the thickest skin. In place of bichromate of potash and muriatic acid, chromic acid may be used. This is a red powder, and when it is used it is not necessary to add any muriatic acid. The same quantity of chromic acid is used as is commonly used of bichromate of potash. When the first bath contains too much acid the skins swell very rapidly until they look like pieces of India rubber. The presence of salt in the liquor prevents this swelling and also hastens the process. The yellow chrome liquor must penetrate through every fibre of the thickest skin before the skins are removed. Carelessness in this respect results in poor leather. When the first bath is completed the skins are removed from the drum, struck out on the machine, or in order to save labor pressed out, to remove the surplus liquor from them, and are then allowed to press and drain for some hours or over night, after which they may be entered into the second bath. The first bath may also be applied to the skins in a vat, although a drum is generally preferred. The quantities of bichromate of potash and acid may vary. Sometimes more than the above-mentioned quantities are used, but always one-half the quantity of chromic acid should be used.

The various methods of tanning goat-skins with one-bath process may be applied in the same manner to calf-skins.

When the skins are taken from the tanning liquors, no matter whether the two-bath or a one-bath process has been used, they are full of the tanning materials. When tanned by a one-bath process, the skins are full of common salt, sulphate of alumina and the salts taken up from the tanning liquors; when some two-bath process has been used, the

leather is full of corrosive acids, which when left in the stock cause serious damage to it. These foreign materials must be gotten rid of and the leather perfectly neutralized before successful coloring and finishing can be attained. The skins are therefore subjected to a very thorough process of washing. The first water in which they are washed may be a borax solution—one-half pound of borax dissolved and added for each one hundred pounds of stock as weighed before trimming. In this water the leather is washed for twenty or thirty minutes or longer, according to the process of tanning that was used. Skins full of sulphurous acid need to be washed in borax water from thirty minutes to one hour. After the washing in borax water the skins are washed for twenty minutes in clear running water. By this procedure the skins are thoroughly cleansed and put in suitable condition for coloring and finishing.

Striking out, pressing and shaving the skins.

When the washing is completed, the skins may be struck out on machines or pressed or struck out by hand on smooth tables in order to remove all the surplus water from them. The striking out on the machine also smoothes out the skins, removes wrinkles and slightly increases their size. Pressing the skins removes the water but does not affect the wrinkles in their skin and does not leave the skins smooth. After being struck out or pressed the skins are shaved, and during the shaving they must be kept from all stain and grease, as the leather in this condition absorbs stain and grease readily, which interferes with the coloring and finishing. By shaving, the skins are made of a uniform thickness, and the flesh side becomes clean and smooth, a very necessary condition when the leather is to receive a glazed finish.

BLACK CHROME-TANNED CALFSKINS.

The flesh side of black chrome leather is usually dyed a

blue or purple color previous to blacking the grain side. The blue back improves the general appearance of the leather and also serves as a bottom or foundation for the black. For this purpose solutions of logwood and borax or sal-soda, blue nigrosines and purple aniline dyes are generally used. The use of logwood chips has been somewhat displaced during the last few years by the use of logwood in extract and powder form. The results that follow the use of these articles are better than the results obtained from the use of even the best grades of chips, since the extracts and powders are always uniform in strength and quality. Logwood paste is a very excellent form of logwood, the only objectionable feature being that when the paste is once frozen the color produced is not at all satisfactory, being a muddy grey-black. The powdered products of logwood cannot be frozen and are consequently always of equal strength in cold and warm weather. When logwood paste is used from six to eight pounds are dissolved in warm water with two pounds of borax or sal-soda, and brought to the boiling point. This liquor is sufficiently strong for all purposes, and should it prove stronger than is required it can readily be weakened by the addition of water. This solution may be used for staining the flesh blue or purple by slightly increasing the quantity of sal-soda or of borax and by adding to it a small quantity of blue or black aniline. The latter articles may be omitted. They serve merely to change the color from blue to purple. When Hemolin, a powdered product of logwood is used, about five pounds of the dye and two pounds of either borax or sal-soda, boiled for a few minutes in fifty gallons of water, give a satisfactory liquor for both flesh coloring and grain blacking. When used for flesh coloring ten gallons of the liquor may be taken for each hundred pounds of leather, weighed after it has been shaved. The skins are drummed in the liquor for fifteen or twenty minutes or until the color is well taken up and developed, then they are washed off, struck out or

pressed again, and are ready for the fat-liquor. Or instead of this, the skins may be taken from the drum and spread on a table and a striker or iron liquor applied over the grain. This leaves the flesh blue and the grain black. Or the skins may be passed through a blacking machine or through dye boxes, and the color changed to black in this way. When this is done, the quantity of hemolin or logwood liquor needs to be increased to twenty gallons for each one hundred pounds of skins.

A very desirable blue flesh is obtained from the use of blue nigrosine.

For each dozen skins of medium size, three ounces of the nigrosine are boiled for a few minutes in two or three gallons of water. This liquor is used at a temperature of one hundred and twenty degrees, and the skins drummed in it for thirty minutes, then they are rinsed off, struck out or pressed and are then fat-liquored and then blacked upon the grain. When the leather is insufficiently washed after tanning, the blue color will not penetrate as it should.

A good staining liquor may also be made of the following ingredients :

Three ounces purple aniline dye and two ounces of black nigrosine or of black aniline are dissolved by boiling in two gallons of water. This solution is mixed with twenty gallons of logwood liquor and used in the manner described for blue nigrosine. About ten gallons of this liquor will stain one hundred pounds of leather, and produce a dark bluish purple. It has one objectionable feature, however, and that is the liability to crack off in handling. This is not liable to occur when the leather has been previously mordanted with some extract containing tannin.

The most simple and easily prepared stain

Is a solution of logwood and borax or sal-soda, made up of one pound of powdered logwood and a few ounces of borax

orsal-soda, boiled in ten gallons of water for each one hundred pounds of leather, weighed after shaving. This stain penetrates freely and makes the flesh a desirable bluish-purple.

Practice in staining, fat-liquoring and dyeing calf-skins.

Some tanners of calfskins stain and fat-liquor their skins at one operation; others stain, fat-liquor and grain black them. The preferred method, however, is to first stain them, then to fat-liquor them, and after fat-liquoring to dye the grain black. The next process, therefore, is the fat-liquoring. By this process the leather is nourished with grease and rendered soft and strong. The quality of the finished leather depends largely upon the quality of the materials used in making the fat-liquor and upon how the process is carried out. While it is very important that the skins are properly treated in the beam-house processes, and thoroughly tanned, it is equally essential that the leather is skillfully curried in order that it may take the desired finish and be free from gum and grease. Tanners frequently succeed very well in making chrome leather up to the point of greasing it, and then fail or at least encounter trouble.

In order that the finished leather may be soft and dry, nothing can be used as a fat-liquor that will make it greasy or gummy, as such condition seriously damages the leather and interferes with the processes of finishing. The heavy oils and greases used by the currier of bark-tanned leather when applied to chrome leather produce very unsatisfactory results. Chrome leather does not need nor will it absorb and carry so much grease as bark leather. The grease must be given to the leather in the form of a thoroughly blended emulsion, all ingredients of which must be incorporated with the other ingredients, in order that the results will be uniform and satisfactory. Various materials may be used in making fat-liquors, but as a general thing potash soaps

and oils are used. These are thoroughly emulsified, and other articles are added, such as degreas and egg yolk according to the class of leather being made. The fat-liquor is used warm and drummed into the leather by means of a pin-mill drum. A drumming for thirty minutes is usually sufficient to enable the leather to absorb all the grease.

Light calf-skins intended for glazed, dull or boarded finish may be fat-liquored with the following emulsion :

Ten pounds of potash soft soap are placed in a barrel with ten gallons of water. Steam is turned in and the soap boiled until it is all dissolved. Four gallons of neatsfoot oil are cut with a few ounces of potash, sal-soda or borax, dissolved in a little water and mixed into the oil. Then the oil is poured into the soap solution in the barrel and the two articles, soap and oil, are thoroughly stirred together. Sufficient water is run in to make a total of forty gallons of fat-liquor, and when the temperature of the liquor has been reduced to less than one hundred degrees, ten pounds of egg yolk are added. The fat-liquor is then thoroughly stirred and applied to the skins at a temperature of ninety degrees F. The egg yolk should never be added until the temperature of the liquor has been lowered considerably from boiling point. For a common quality of leather the egg yolk may be omitted, as good results are obtained from the mixture of oil and soap.

For heavy calf-skins

Ten pounds of Moellon Degreas may be added to the solution of oil and soap, and the egg yolk omitted. A good fat-liquor is also made of forty pounds English sod oil and twenty pounds alkaline soft soap, boiled and emulsified as above described, and enough water then run in to make fifty gallons of fat-liquor. When no egg yolk is used, the fat-liquor may be used at a temperature of one hundred and twenty to one hundred and forty degrees.

The hotter it is, the more readily and uniformly it will penetrate the leather, provided the leather is free from surplus water, and no acids nor tanning materials are left in the skins. When the blue color has not penetrated as it should, it is sometimes an advantage to add a small quantity of color to the fat-liquor which will be carried through the skins.

After the leather has been flesh colored, the skins should be struck out on the machine or pressed to get rid of surplus water and then fat-liquored. A suitable stuffing drum is heated with live steam to a temperature of about one hundred and forty degrees. Then the steam is let out of the drum and the condensed water is drained out, the leather thrown in, the drum closed and run for a few minutes to warm the leather. The fat-liquor is then added through the hollow gudgeon of the drum, one or two gallons at a time, until the whole quantity required is in, then the leather should be drummed in the fat-liquor for at least thirty minutes, or until it has taken up all the grease, and nothing but water is left behind.

The quantity of fat-liquor required by a lot of leather depends upon how soft the leather is wanted. Too much fat-liquor causes the leather to work through greasy, spongy and stretchy, while not enough leaves it stiff and like paper. Such leather, being insufficiently nourished, is dry and harsh and liable to crack and break. From two to four gallons of fat-liquor, prepared as suggested, are usually required for each dozen small light skins. Heavy, large skins require more.

At the end of the fat-liquoring process the leather may be removed from the drum and thrown over horses or laid out flat in piles for some hours, in order that the grease may combine with every fibre. Then the skins are grain-blackened, provided this has not been done before fat-liquoring, as is sometimes the case. When the grain-blackening is done by hand or on machine it should not, and usually is not done after it has been fat-liquored.

The grain-blackening may be done by hand with brushes on tables, by passing the skins through the coloring machine, or by being dyed in trays or dye boxes. All of these methods are in general use, the tray and machine methods being the most frequently employed.

For blacking the grain,

Logwood or some product of logwood is generally used. The coloring properties of logwood in powder form are very satisfactory. A good coloring liquor is made by boiling eight pounds of such powder and two pounds of borax or sal-soda in twenty-five gallons of water. Then enough water is added to make forty gallons of dye liquor. When the grain-blackening is done on a machine the skins are taken after fat-liquoring and run through the machine, and the dye liquor spread over and brushed into the grain, then the color is developed and set by the application of an iron liquor or a solution of copperas.

In tray or box dyeing the skins are folded through the centre, grain side out and worked through the dye liquor and then through the striker. The skins may also be drummed in logwood liquor for fifteen minutes, then spread on a table, and the striker applied by hand, or they may be run through a machine and the color set in this manner. A few fustic chips or a small quantity of fustic extract boiled with the dye intensify the black. It is very important that the color be well rubbed into the leather in order that the grain will not show grey bottom.

A good striker may be made

Of five pounds of copperas and one and one-half pounds of blue vitriol dissolved by boiling in a half barrel of water, then the barrel may be filled with water. When used on a machine twelve pounds of copperas and four pounds of blue vitriol are used for a barrel of water. To this are added one and one-half pounds of ground nutgalls and one pound of epsom salts to each six pounds of copperas and blue vitriol

combined. When the coloring is done on a table a small quantity of ammonia should be added to each pailful of dye. This is brushed into the leather, then the striker is applied. Another coat of dye is given and more striker, then the leather is washed off and struck out.

A good iron striker

Is made of three gallons of iron liquor and two pounds of copperas dissolved in two quarts of vinegar boiled for a few minutes. In place of verdigris blue vitriol may be used, three-quarters of a pound dissolved in two quarts of boiling water. The liquor should be well stirred and not used until the next morning, when the clear liquor may be drawn off and diluted for use with two or three times its volume of water. Trouble is often met with in getting a good black color on chrome leather. This may be prevented by mordanting the leather, after it is washed from the tanning liquors, with a solution of tannin. Palmetto extract is very good to use in this way, as it leaves the grain smooth, and produces a soft feel to the leather. For three hundred pounds of chrome leather one and one-half quarts of extract and a small quantity of glycerine mixed with warm water make an excellent mordant.

After the grain has been dyed black it should be washed off and the leather struck out. Machines are commonly used for this work. After striking out an application of glycerine and water should be given the grain of the leather, equal parts of glycerine and water, put on evenly with a soft rag or a sponge. The leather may then be struck out again although this is not necessary. Whether the leather is struck out or not, a coat of oil is next applied. The oil should be warm and applied with a sponge evenly over the grain, in quantity according to the condition of the leather and the degree of softness desired. Before this oil is put on the water should be well gotten out of the leather, so that the oil can the more readily penetrate into the leather,

where it will add strength and softness to the grain. The oil used in this way is the base of the subsequent finish and it behooves the tanner to use good oil. The oil also helps the black of the leather. Neatsfoot oil is often used, although other oils such as a good grade of cod oil and sperm oil are commonly used and very often preferred to neatsfoot.

After the oiling operation

The leather is dried out in any suitable manner. The skins may be stretched in frames, tacked on boards or hung up and dried. Usually they are stretched in frames or on boards in order that the stretch may be taken out and the leather made flat and smooth. After the skins become dry they are packed down in damp sawdust to moisten and soften them preparatory to being worked out and finished. As soon as the damp sawdust has softened the skins they are staked on the staking machine, and dried again, staked once more and then thoroughly dried. The leather is now ready for the final finish. On this kind of leather three styles of finish are wanted—smooth glazed, dull and boarded or box finish. For a glazed finish either smooth or boarded, the skins are cleared of greasy matter in the grain, by a dilute solution of lactic acid, made up of one gallon acid to three or four gallons of water. This is thoroughly rubbed into the grain and the leather dried again, after which the seasoning is applied. Some leather finishers prepare their seasonings while others buy them already prepared, and thus save the labor of making them. In many instances it is best for the finisher to buy seasoning, as the firms who make this their specialty know exactly what is required and supply very superior dressings. Levant inks are generally used. They are procurable ready for use and need only dilution with water.

A seasoning suitable for calf-skins may be made in the following manner :

Six ounces of black nigrosine, dissolved in five gallons of

water, to which are added two pints of blood, five ounces of glycerine and eight ounces of ammonia. Logwood liquor, blacked with copperas, may be used in place of the nigrosine.

Another formula :

One pint blue-stone, one-fourth ounce iron, one pint logwood, one quart blood, one pint nigrosine. The seasoning or glazing liquor should be applied evenly over the grain and thoroughly rubbed in. Hand work and machines are used for this work. The less seasoning that is used to produce a clear, bright finish, the better it is, as the leather so treated stands handling better than when a great deal of seasoning is used. After the seasoning liquor becomes dry, the leather is glazed. A second coat of seasoning is applied and the drying and glazing repeated. Sometimes a third treatment is necessary. Between the first and second glazing it is sometimes an advantage to apply a dilute solution of lactic acid or of vinegar and bichromate of potash. This seems to clear the bottom and to deepen the black. The flesh side of the skins is made soft by scraping on a machine. For smooth, bright finish, the leather is finally brushed over lightly with an oily cloth or sponge and is finished, while for boarded or box finish, the leather is boarded both crosswise and lengthwise, supplemented in some instances by printing on a machine, and is ready for market. For dull or mat finish, a dull seasoning is applied in the same manner as the glazing liquor, and while slightly moist, the leather is rolled or ironed. Measuring and grading complete the process.

COLORED CHROME-TANNED CALF-SKINS.

Before any attempt at coloring chrome-tanned calf-skins is made, they should be thoroughly washed and shaved. They may then be prepared for the desired shade of color by being slightly retanned with palmetto extract. This

material neutralizes any acid in the skins, and makes the grain tough and smooth and firm and in good condition without further mordanting to receive an aniline dye. A practical method of using the extract for the purpose is to treat the skins with the extract liquor in a drum. The liquor may be made up of one gallon of extract and one-third of a pint of glycerine for one thousand pounds of leather. The quantity of water necessary to properly drum the skins is used; and the temperature of the liquor when it is applied to the skins should be from ninety to one hundred degrees Fah. The stock should be drummed in the liquor for thirty minutes, then to the bath, without removing the skins from the drum, may be added for each dozen skins, about four ounces of tartar emetic or of antimonine, dissolved in one gallon of hot water, and the drumming continued for twenty minutes. The use of either of the last named articles is for the purpose of preventing spots upon the leather, caused by tannin not fully combined with it, to clear the grain and to act as a settling agent for the dye. The work of mordanting and preparing the skins for coloring may also be done in the paddle-vats or reels.

*In place of palmetto, and with equally good results, sumac may
be used,*

In drums, about eight or ten ounces of sumac being used for each dozen small light skins. Large, heavy skins require about one pound of the extract for each dozen. Or, the liquor may be made up in a vat at a temperature of one hundred and twenty degrees, and the skins paddled or stirred about therein for one-half hour or longer, and then treated with the clearing agent as above suggested, washed off and colored.

The skins may be prepared with sumac in this manner:

Two hundred pounds of leather, after washing and shaving, are placed in a drum, with a solution of sumac extract

made up of eight pounds of extract scalded in six gallons of hot water and mixed with about sixty gallons of water at a temperature of about one hundred degrees. The extract liquor is divided into three portions, the skins and the first portion being put into the drum and drummed for ten minutes, then another portion of the liquor is added, and at the end of five minutes the last portion is put into the drum, and the drumming continued for thirty minutes. At the end of this time the leather will have absorbed all the tannin. Then the tartar emetic may be given to the skins, and after a further drumming for fifteen minutes, the spent liquor may be run off, the skins washed in lukewarm water, and are ready for the dye. Sumac leaves may be used in place of the extract; and for dark shades a liquor made up of one-third sumac and two-thirds terra japonica or gambier may be used.

The extract of fustic is another excellent article to use as a mordant.

It may be used for almost any shade, and makes a very good bottom for an aniline dye. For some dark shades it may be combined with a pure logwood liquor. Morin Yellow, Pat., is a product of fustic, and much to be preferred over chip fustic. It is an excellent fastener of aniline dyes, and with its use full nourished colors are obtained. The coloring of chrome-tanned calf-skins is best accomplished before they are fat-liquored. A few necessary precautions to be observed by the dyer are that the skins should be perfectly clean and free from grease, stain, dirt or tanning materials, such as acid and salt; that the dyes are carefully prepared by being dissolved in boiling water and boiled a few minutes and strained before they are used. Also that the drum and other vessels used are perfectly clean, and the water not only clean, but soft.

The following directions will be found of practical value to any one attempting to color chrome-tanned calf-skins.

Any one of the methods of preparing the skins may be used. After mordanting and cleansing, the skins should be washed off and are then ready for the color solution.

Chocolate Brown. 1. For one dozen medium-size calfskins, about seven ounces of aniline Chocolate Brown, 270, may be used. The skins should be drummed in the color solution for twenty minutes, and then washed off and fat-liquored.

2. At a temperature of 120 degrees, a color solution may be used, made up of the following dyes in the proportions named. Eight ounces of phosphine for leather; one-half ounce leather-green M; two-thirds of an ounce of dark methyl violet, thoroughly dissolved and strained before using.

3. By combining phosphine with leather-brown, in the proportions of one-third of the latter to two-thirds of the former, a very desirable shade of brown is obtained.

In every instance, to insure even coloring, the solution of dye should be added to the skins either through the funnel of the wheel, or the skins should be thrown back upon the pins and the color put in at the door. It is always productive of the best results to add the dye in portions, allowing one portion to be taken up before another one is applied.

Upon skins re-tanned or mordanted with tanning extracts, very satisfactory shades of dark wine color, commonly called ox-blood, may be obtained by applying the following formulas :

1. The skins may be run in a solution of dye—six and one-half ounces of amaranth 3-R for each dozen skins for twenty minutes. Then may be added in the following order, two and one-fourth ounces of amaranth 1-R and one ounce of chocolate brown, each dye being dissolved and

given to the skins separately. A drumming for one-half hour completes the process. At the end of the operation it may be well to add one ounce of bichromate of potash five minutes before stopping the drum.

2. A good shade of ox-blood is also obtained by using from ten to twelve ounces of the aniline amaranth 3-R, for each dozen skins, according to the size of the skins. The dye should be dissolved in one gallon of boiling water, to which a few ounces of glycerine may be added; and the liquor then boiled until the dye is completely dissolved. The solution should be strained through a piece of cheesecloth and cooled down to about 120 degrees before it is applied to the skins. When tartar emetic is used, nothing more is needed to set the color. After a drumming in the dye for thirty minutes, the skins may be removed from the drum, washed off and fat-liquored.

3. By combining a dark red aniline with a dark brown, for instance, Bismarck brown, a rich shade of ox-blood results. About one-third as much brown dye as red dye should be used. For one dozen medium skins, seven and one-half ounces of the red, and two and one-half ounces of the brown may be used.

Light tan shades: 1. Patent Phosphine G. is an exceedingly bright color, and when used alone produces a very light yellow tan shade.

2. By combining Patent Phosphine G. with a Bismarck brown, a reddish tan is produced. Numerous shades of tan, ranging from very light to dark, may be obtained by combining the phosphine with browns, and also with blues and greens, by which the shades are subdued and mellowed. One part leather-brown, and four parts phosphine produce a very desirable dark tan.

Sulfamine dyes may also be used with very satisfactory results upon chrome-tanned calf-skins.

Sulfon Brown B. is a very valuable dye, and by various

combinations an almost unlimited number of shades are made. By using, for example, two and one-quarter ounces of Sulfon Brown B., nine and one-half ounces of Sulfon Carmine B. and two and one-half ounces of hæmatine powder, in combined solution, a dark rich ox-blood is obtained, the quantities of dyes named being for one dozen skins.

Six ounces of Sulfon Brown B., one-fourth of an ounce of Sulfon Carmine B. and one ounce of Urania Blue, produce a rich chocolate brown. A shade a trifle lighter than the foregoing: Four ounces of Sulfon Brown B., one and one-half ounces of Urania Blue, one-half ounce of Sulfon Carmine B. A light chocolate brown: Three and one-half ounces of Sulfon Brown B. and one ounce of Urania Blue R. For an ox-blood shade: Eleven ounces of Sulfon Carmine B., one-half ounce Sulfamine Yellow D. and three ounces of Hæmatine Powder. In using these dyes, it is generally good practice to add to the color solution a small amount of Carbonate of Ammonia, which makes the color penetrate more quickly, but this should be neutralized afterwards with a little acetic acid. Immediately after dyeing, the skins should be fat-liquored, and here care must be exercised to have the fat-liquor perfectly neutral, as the shades are readily injured by any excess of alkali in the fat-liquor. For fine light skins, an emulsion or mixture of egg yolk and neatsfoot oil makes an admirable fat-liquor.

Fat-liquoring.

After the leather has received the right shade of color, it should be washed off, struck out or pressed and fat-liquored. For heavy skins a fat-liquor may be made of soap, oil and degreas, in proportion as follows: Ten pounds of soap are boiled in a few gallons of water until thoroughly dissolved, then four gallons of neatsfoot oil and six pounds of degreas are added and the whole thoroughly emulsified by boiling and stirring, then enough water is run in to make forty gallons of liquor. Very light skins

may receive an emulsion of soap, oil and egg yolk in place of degreas. The fat-liquoring and finishing of colored calfskins is carried out in the same manner as upon black skins. Fancy shades should be dried out in a darkened room, and must be kept clean. No black dyes or leather should be allowed in the same room with light colored stock. Too much care cannot be taken with colored leather.

CHAPTER XVI.

CALF-SKINS.—VEGETABLE AND COMBINATION- TANNED.

Palmetto extract

Is a comparatively new tannage, and not so well known among tanners as the older processes. It is a perfect substitute for gambier, and makes soft, tough leather of very light color, well adapted to finishing up into colored or black leather. It produces good results when used in drums, tanning skins thoroughly in a few hours. The skins for this tannage are treated in the usual way in the beam-house. They are soaked, fleshed and limed. The first lime should be rather weak, and after the skins have been therein for one day they may be passed into stronger limes, or the weak lime may be strengthened. At the end of four or five days the skins are placed in fresh lime made up of seventy-five pounds of lime and five pounds of red arsenic or sulphide of sodium for fifteen hundred pounds of skins. Upon the sixth or seventh day the skins may be unhaired and then left a day or two longer in fresh lime. They are then washed, bated, worked on the grain, washed off again, and are ready for tanning. At the beginning of the process the skins may be left in cold palmetto liquor of about eight degrees Baumé for from one to two hours or until they are uniformly colored. Then they are tanned in a drum with a palmetto liquor of thirty degrees Beaumé, 51 Twaddle, at a temperature of eighty-five degrees. For seven hundred pounds of skins, weighed as they come from the beam-house, four hundred and fifty pounds of extract may be used. In about six hours the

skins are tanned through. Light skins require less time, according to their thickness. After skiving or splitting, the leather is retanned for one-half hour in a drum in liquor of eight degrees Baumé, and then for one hour with strength of liquor thirty degrees Baumé. The leather is then washed in lukewarm water for twenty minutes. The water in which the skins are washed after tanning may be used as a coloring liquor for a fresh lot of skins coming from the beam-house. After washing, the leather is pressed and left in piles for forty-eight hours and is then fat-liquored.

The fat-liquor for this tannage

May be made of five pounds of potash soap and one gallon of degreas boiled until dissolved and mixed in one-half barrel of water. The drum should be heated to a temperature of 140 degrees. The quantity of fat-liquor mentioned is sufficient for four hundred and forty pounds of pressed leather. The leather should then be drummed in the fat-liquor for thirty minutes; then placed over horses or in smooth flat piles to press and drain for a few hours. The grain is next well struck out and given a light coat of oil, after which the leather is hung in a warm room and dried. Leather made by this tannage may be colored and finished in a great variety of ways.

Hemlock, quebracho, gambier and other tannages.

Calf-skins are tanned in a number of ways. In addition to the palmetto process as above described, hemlock liquors are used alone and in combination with other tannages, such as quebracho and gambier; palmetto extract may also be combined with hemlock and other materials; the dongola process is used, and also combinations of chrome and vegetable processes. The tanning is done in vats provided with paddles, by which the tanning liquor is stirred and the tanning made uniform and thorough. Vats

without paddles are also used, and some tanners tan thin skins in pin mill drums exclusively. Still tanning, by which the skins are not violently agitated, produces the plumpest and best filled leather, especially in the flanks and along the sides.

Some tanners start the skins in hemlock liquor and finish them up in gambier, palmetto or dongola liquor. Gambier has long been a staple tanning material, and largely used by the makers of fine light leathers. The leather made with gambier is soft and tough and can be colored and finished in any desired manner. Very good leather is made by combining gambier with a chrome or mineral process. When gambier is used alone, the tanning is a very simple, straightforward process. The skins are usually started in a weak liquor and this is gradually strengthened by the addition of fresh gambier until it becomes strong towards the end of the process. Common salt is very useful in gambier tanning. It helps to make soft leather and also hastens the tanning process and prevents contraction of the fibres. Heavy skins, after becoming well struck with the tanning liquor, are split and then re-tanned in gambier. Palmetto extract is very useful in the re-tanning of calf-skins. It puts the leather into condition to stand heat well and to take and carry grease, and it also toughens the leather and makes it more waterproof. Skins can be started in a gambier liquor and tanned out of a palmetto liquor. The leather, after the tanning is completed, may be strengthened and cleared by being milled in a drum in a solution of alum and salt. In about thirty gallons of water are dissolved fifteen pounds of alum and ten pounds of salt, this quantity of liquor being enough for two hundred and forty skins. In this solution the skins are drummed for thirty minutes, and should then be allowed to drain well. It is well to remove the surplus tanning liquor by washing the leather in a drum in lukewarm water for about twenty minutes. Then the leather is ready

for pressing, fat-liquoring and drying out; or it may be dried out first and then moistened and fat-liquored.

Skins may be tanned in liquors made up of palmetto and hemlock or other extracts in almost any proportion, and then retanned in the same liquors or in a straight palmetto liquor. Tanning extracts are combined in various ways. Quebracho and gambier are used in combination, also quebracho and hemlock. Quebracho is an excellent tanning material, but when it is used alone it does not plump the leather enough. The best results are obtained when it is combined with other materials. The color of quebracho tanned skins may be improved by the addition to the liquor of a small quantity of divi-divi. Quebracho is very useful in tanning calf-skins for patent or enameled leather, on account of the pliability of the leather made with it. When quebracho is combined with hemlock extract the leather made is very tough and soft and of a fair uniform color and well filled. The liquor may be two-thirds quebracho and one-third hemlock, used either in drums or vats.

Re-tanning chrome leather with gambier or palmetto.

Leather that has been made by a chrome process may be retanned with gambier or palmetto. The latter extract has the good effects of neutralizing any trace of acid left in the leather, and also serves to put the leather in good condition to receive any shade of color or black. The grain is made smooth and remains so. For the retanning of three thousand pounds of chrome tanned calf-skins three gallons of palmetto extract and one pint of glycerine may be used. The extract is dissolved in the quantity of warm water required; and the liquor when used should be at a temperature of 90 degrees Fah. When a one-bath process is used the skins may be tanned first in chrome liquors in drums or paddle-vats and then retanned in gambier or palmetto; or they can be given a light tanning with the extract and

then tanned in the chrome liquors. Heavy calfskins may be split before tanning after the liming process, which has been made possible by recent improvements on splitting machines, and the grains, after bating and drenching, may be tanned in any process of tanning, and the fleshs or splits drenched and made into glove leather.

Ons-bath chrome liquors are handled in much the same manner as bark or gambier liquors, that is to say, the skins are entered into a weak liquor containing to each one hundred gallons of water, two or three gallons of chrome liquor, and the bath is gradually strengthened by the addition of chrome liquor until it contains from four to six gallons of the same to each one hundred gallons of water. The tanning is also done in drums.

Hemlock or combination liquors for calfskins and kips.

Heavy calfskins and kips are sometimes tanned in hemlock or combination liquors, and after splitting are retanned in gambier, or dongola liquor made up of salt, alum and gambier. Hemlock is a good filler, but is of a very harsh nature. Skins tanned in hemlock are much improved by the subsequent treatment with gambier or dongola liquors. These materials tone down the harshness of the hemlock and produce a soft silky feel on the leather. The leather is made supple, firm and tough, and put in good condition to receive and retain the black. When gambier is used in this way the liquor may be prepared by boiling two hundred and fifty pounds of the same in eighty gallons of water. The skins, sixty in number, or thirty sides, are put into the drum with ten gallons of the gambier liquor, to which may be added a pailful of dry American sumac, and the amount of water considered necessary. A running in this liquor for thirty minutes is sufficient.

A good dongola liquor.

A good dongola liquor may be made of the following proportions: In one hundred gallons of water are dissolved

by boiling thirty pounds of salt, and forty pounds of alum. These should be boiled until they are thoroughly dissolved. One hundred and eighty pounds of gambier are boiled in two hundred and fifty gallons of water until dissolved, and the gambier liquor and the alum and salt solution are then mixed together in a vat or tub. By the addition of one hundred gallons more of water, and one quart of sulphuric acid, there are made five hundred gallons of dongola liquor. The skins may be tanned from the first in this dongola process, either in drums or vats, and very desirable leather is in this way made. When the tanning or the retanning in dongola liquor is finished the leather is washed and pressed, and then given some oil in a drum. Three gallons of neatsfoot oil may be used for this purpose for each three hundred pounds of leather. Fish oil may also be used. The leather is drummed in the oil for twenty minutes, then hung up and dried out. The oil prevents the grain from cracking during drying. The skins are then stored away until they are to be finished.

When the dongola process is used from the beginning the skins may be pickled after bating and washing in salt, sulphuric acid and water—five hundred gallons of the latter, two hundred pounds of salt and thirty-five pounds of acid being used and the skins stirred about in the liquor for about six hours. Then they are entered into the salt, alum, and gambier liquor. One way of making up the liquor is to prepare a gambier solution of about six degrees barkometer, to which are added ten pounds of alum and seven pounds of salt for each one hundred gallons of liquor. When tanned, the skins are drained or pressed, and in the case of heavy skins or kips they are split, and then retanned in a gambier liquor. The leather can also be made by applying first the alum and salt and then the gambier liquor. The splits may be tanned in various ways according to what they are to be used for. The best way to treat splits full of alum and salt is to mill them in a drum in a

weak gambier liquor until they are thoroughly softened. Then they may be tanned in bark or extract liquors and filled. In this way no salt and alum will be left in the stock to spew out upon the surface after the leather is dried out. To wash the splits in water previous to putting them in the bark or extract liquors makes them flat and lacking in plumpness. It would be impossible to plump them again and nothing but flat and lifeless leather would result. By milling them in gambier liquor the plumpness and fullness are retained. The splits are tanned in almost as many ways as the grains. Hemlock, quebracho, bark and combination processes are used, according to the qualities required in the leather.

To fat-liquor combination and vegetable-tanned calf-skins.

When the tanning in gambier or other vegetable tannage is completed, the skins should be removed from the tanning liquor and thoroughly pressed, so as to remove the surplus liquor and then left in piles for forty-eight hours. The stuffing drum should be heated to about one hundred degrees, and one gallon of oil added for every hundred pounds of stock weighed after pressing and draining. Let the skins run in this until the oil is well taken up and absorbed, which requires about forty minutes; then take the leather from the drum and hang it up and let it dry out. After drying, the stock should be weighed and then wet in a tub and piled up for a number of hours to soften. This is better than softening in a drum, as it does not pipe the grain. The skins may be shaved at this point and then put into the drum and run with just enough water to soften all parts alike. Any excess of water should be drained off, and the leather next given the fat-liquor. The temperature of the drum should be about 120 degrees. For every one hundred pounds of dry weight stock, the maximum quantity of fat-liquor is twenty gallons. This quantity is sometimes too much, and a smaller quantity

may often be used and the leather still be quite soft enough. The leather should be drummed in this fat-liquor until all the grease is taken up; then it should be hung up and dried out again.

Other fat liquors.

A very good fat-liquor may be compounded as follows: About twenty-five gallons of water are put into a barrel. To this are added twenty-five pounds of suitable potash soft soap, and this boiled until it is thoroughly dissolved. Then about fifty pounds of English sod oil and one and one-half gallons of neatsfoot oil are added and the mixture thoroughly stirred until completely combined. It is good practice to cut the oil before using it by pouring into and stirring a few ounces of sal-soda or borax dissolved in hot water. Enough water is next added to make a total of fifty gallons of fat-liquor.

Fat-liquors may also be made according to the following formulas: Ten pounds of suitable soft soap are boiled in ten gallons of water until all is dissolved. To the soap solution are then added four gallons of neatsfoot oil and ten pounds of degreas, and the ingredients are thoroughly mixed together by boiling and stirring. Enough water is then added to make fifty gallons of fat-liquor. Three pails soft soap, four gallons sod oil, two pounds borax, ten pounds degreas, also makes a good fat-liquor. Five pounds degreas, three pounds cod oil, three pounds neatsfoot oil and two pounds paraffine oil may be used. After the fat-liquoring of the leather is completed, the stock should be hung up and dried out.

THE COLORING AND FINISHING OF VEGETABLE AND COMBINATION TANNED CALFSKINS.

After becoming thoroughly dried out the skins may be kept in storage for some time before they are colored and finished. When the coloring and finishing operations are

to be carried out, the dried leather is moistened in warm water and placed in piles for twenty-four hours, to become thoroughly moistened through and soft. For black leather the flesh is next colored blue or yellow as may be desired.

For a blue flesh a solution of logwood is most commonly used. To the logwood solution may be added a few ounces of blue aniline or of nigrosine. Of logwood extract, paste or powder, one pound of the same may be boiled with a few ounces of borax or sal-soda in ten gallons of water and used for each one hundred pounds of leather. The leather is milled in the color solution for twenty minutes, then removed from the drum and dyed black upon the grain with logwood and striker. A stronger solution than that mentioned above may be used, and after the leather has been drumming in the same for twenty minutes, it may be spread on a table or run through a machine and the color developed by the application of the striker. This method gives a blue flesh and black grain.

A good blue flesh is obtained from the use of blue nigrosine. For twenty-four skins of medium size, eight ounces of nigrosine are used. This is dissolved in boiling water and applied to the leather at a temperature of 90 degrees Fah. A running in this liquor for twenty minutes enables the leather to absorb all the dye, after which it may be blacked upon the grain, oiled off and dried out.

For yellow flesh, the stock should be uniformly and thoroughly moistened. The one-half pail of sumac is scalded for two hours in a closed vessel. When it is wanted for use, to the sumac liquor one gallon of lactracine and four pails of water are added. This quantity of liquor is sufficient for ninety calf-skins of average size. The temperature of the liquor should be from ninety to one hundred degrees, and the leather milled in the solution for thirty minutes. Then the skins should be piled up on both sides of the drum and the color solution added. One pound of Yellow S. is dissolved in one-half barrel of water. After the drum-

ming in the sumac, four pailfuls of the color liquor are added to the sumac bath and the leather is drummed therein for ten minutes, or until the latter is permeated with the yellow dye. The grain is next blacked with logwood and striker, then well set out, oiled lightly and the leather dried out and finished in any desired way. In place of the sumac, fustic may be used. Morin Yellow is a product of fustic, and superior to chip fustic. It is excellent as a mordant upon any class of leather. It is readily dissolved in boiling water and used in the same manner as described for sumac.

In dyeing leather black upon the grain

Some form of logwood is generally used. Logwood chips, logwood extract in paste and solid and liquid form are used; also the powdered products of logwood such as Hemolin XS Patd., Hæmatoxylin, and Hæmetine. The use of logwood chips in leather dyeing has been greatly superseded during the last few years by the use of logwood in powder and extract form. The results gotten from the use of these articles are better and more uniform than the results obtained from the use of chips, since the extracts and powders, and especially the latter, are always uniform in strength and quality. Logwood paste is very excellent so long as it does not get frozen. When once frozen the color produced is not satisfactory, being a muddy grey black. This trouble is not met with in using the powders. Logwood chips require a very thorough and long boiling to get the color all extracted.

When the logwood paste is used from six to eight pounds of the same are dissolved in forty gallons of warm water with one-half pound of borax or sal-soda, and brought to the boiling point. This liquor is very strong and may be reduced in strength by the addition of more water. Hemolin and other powdered dyes are used in the proportion of about six pounds of the powder to a barrel of water. The

dye is first boiled for a few minutes in one-half barrel of water and then the barrel is filled. From one to two pounds of borax or sal-soda may be added to the dye liquor. A few fustic chips may also be boiled with it and serve to intensify the color.

The leather may be blacked in a drum, on a machine, on tables or by being folded and passed through the dye in boxes or trays. It is first given the logwood dye, and then the striker. Sometimes two or three applications of the dye are required to get a satisfactory black, according to the strength of the liquors.

Strikers, as they are commonly called, which are used to develop the color, are made according to the following recipes :

(1) Four and one-half pounds of copperas, and one and one-half pounds of blue vitriol, dissolved in one-half barrel of water by boiling. Then the barrel is filled with water. For use in machine dyeing twelve pounds of copperas and four pounds of blue vitriol are used for each barrel of water. To this are added one and one-half pounds of ground nutgalls, and one pound of Epsom salts to each six pounds of copperas and blue vitriol combined.

(2) Nine pounds of copperas, four ounces sulphate of magnesia, six ounces acetic acid and one ounce nutgalls, mixed together and dissolved by boiling in ten gallons of water, and then turned into a barrel, and enough water added to make forty gallons.

(3) Three gallons iron liquor, two pounds of copperas, dissolved and mixed together. Three quarters of a pound of verdigris dissolved in two quarts of vinegar and added to the copperas and iron liquor. In place of verdigris, three quarters of a pound of blue-stone dissolved in two quarts boiling water may be used. The liquor should be well stirred and allowed to settle, and the clear liquor only used.

(4) Nine pounds of copperas, one-fourth pound of Epsom salts, six ounces of acetic acid and one ounce of nutgalls. Forty gallons of water.

Soft water, or better still, condensed steam should always be used in making blacking, dye liquors and finishes.

After the grain of the leather is dyed black, it should be washed off with warm water, and well set out. Then a light coat of oil should be applied evenly over the leather, and the leather then hung up and dried out.

For a dull finish, the leather is given an application of a dull dressing and then ironed or rolled. For glazed finish, a different kind of dressing is used than for dull finish. A coat of the dressing or seasoning is applied evenly over the grain and well rubbed. The leather is hung in a warm room to dry, and when it is dry it is glazed upon the glazing machine. Two, and even three applications of the glazing liquor and two and three workings upon the machine are required to produce a bright, deep and lasting gloss. In regard to seasoning liquors, it is very often better for the tanner to buy seasonings prepared by firms who make that their business, than to attempt to make his own seasonings. The seasonings that the tanner buys ready for use at the present time are of very excellent quality. Many tanners buy all the leather dressings, while others prepare them themselves.

In order to get a perfectly satisfactory finish it is necessary that the seasoning should be thoroughly rubbed into the leather. The grain must be free from grease. A dilute solution of lactic acid in water applied over the grain, well rubbed in and dried before the seasoning is applied, does a great deal towards getting a clear, bright finish.

The receipes given for seasonings, in other parts of this book, produce very good results upon calf-skins.

Gambier, palmetto and combination-tanned calf-skins.

Gambier, palmetto and combination-tanned calf-skins and sides intended for colored leather, after being fat-liquored are dried out, are then moistened in warm water in a tub and placed in piles for a number of hours to become

thoroughly softened. To prepare them for any shade of color they are, preferably, milled in a drum in a solution of sumac prepared in the following manner: For sixty medium sides or ninety average calf-skins, one-half of a pail of sumac is scalded in a closed vessel for two hours. To the sumac solution are added four pails of water and one gallon of Lactracine. The temperature of this liquor when it is applied to the skins or sides should be 100 degrees Fah., and the leather should be run in the same for twenty-five minutes. This prepares the leather for the process of coloring, and is a very practical method, simple and easy to use and always productive of good results. It can be applied to skins and sides tanned in any process or combination of processes.

In some instances it is not necessary to use sumac for the purpose of freshening up the leather, depending upon the nature of the tannage and the condition of the leather. It is always good practice, however, to thoroughly soften the stock before applying any dye to it; and it is also well to wash the leather in warm water in order to remove from it all the particles of dirt, dust and tannin.

In the treatment of leather that has acquired a dark color from the tannage, it is advantageous to bleach the stock before coloring it. Practical methods of bleaching leather are given in another chapter. They produce good results when applied to calf-skins and sides.

Preparing the skins by the use of tartar emetic and antimonine.

When leather has been freshened up in a sumac bath, it is apt to contain uncombined tannin, which has a tendency to cause uneven and cloudy coloring. To prevent such a result, tartar emetic or antimonine may be used. In using either of these articles, the leather is first milled in a sumac liquor. This may consist of one pound of extract of sumac in the required quantity of water at 100° F., for four dozen medium-sized skins or thirty-two average

sides. In this liquor the leather is drummed for twenty minutes, then for the quantity of stock mentioned one-half of a pound of either tartar emetic or antimonine may be dissolved in warm water and added to the leather and sumac, and the drumming continued twenty minutes longer, when the grain will be cleared and ready for the aniline dye. No bichromate of potash or other setting agent will be required, as the aniline will be fixed firmly and evenly upon the leather. The leather should be washed off before it is colored. Aniline and sulphamine dyes are used almost exclusively in coloring leather. They produce very good results, and the number of shades that can be produced with them and by combining two or more colors, is almost unlimited.

Aniline dyes on vegetable tanned stock.

Practical instructions regarding the use of these dyes and specific directions for combining two or more dyes to produce various shades, are given as applied to chrome tanned skins. The instructions given may be followed out in coloring vegetable tanned stock, by preparing the leather as above suggested, and using the dyes as directed for chrome tanned leather. The coloring must be done carefully and cleanly, in order to get deep and uniform coloring. After the leather has assumed the desired shade it should be washed off, set out and dried out. Some tanners color their leather before fat-liquoring it, others afterwards; and some fat-liquor their stock, dry it out and color it, and then give it a second application of fat-liquor.

CHAPTER XVII.

CALF-SKINS TANNED FOR GLOVE AND MITTEN PURPOSES.

Alum processes.

VERY soft white leather, of excellent texture and strength, adapted to any purpose for which such leather is required, may be made from calfskins by any alum process. The skins may be prepared in the usual way of soaking, lining and bating. By pickling the skins in a bath of water, sulphuric acid and salt previous to tanning, they are bleached a perfect white, and this is something of an advantage. Before they are treated with alum and salt the acid must be gotten rid of, or the leather will be hard and stiff and lacking in strength when it is finished. To accomplish the removal of the acid and the neutralization of the skins a drench of sour bran and salt may be used, also a drench of whiting and salt. Either of these may be used alone, or the whiting and salt method may be applied to the skins and then a light sour bran drench used. All traces of whitening must be washed off either in the bran drench or in warm salt water, before the skins are tanned. The use of the salt is absolutely necessary to keep the skins from swelling. When no pickling process is used, and it is not necessary to use it, the skins are bated and washed and cleaned, and are then ready for tanning. For every hundred pounds of skins to be tanned a solution may be prepared of twelve gallons of water at a temperature of 90 degrees Fah., six pounds of alum, six pounds of salt, twenty pounds of wheat flour and twelve pounds of egg yolk, all thoroughly mixed together and applied to the skins in a drum. The skins may be drummed in the liquor for one hour, then removed

and dried out. After drying they should be allowed to lie in crust for some weeks and even months, the longer the better, to cure. They may then be moistened, staked, dried and finished, and will work out into very soft white leather. The soluble oil commonly called Turkey red oil is well suited to replace the egg yolk.

The skins may be pressed after drenching and passed through a warm solution of the oil, made up of ten gallons of the same in one hundred gallons of warm water, and then dried out. Then they may again be treated with the oil and then tanned with the alum liquor. The leather is made remarkably flexible and soft and has a very fine appearance. To the oil solution some carbolic acid may be added to prevent heating of the skins while they are stored away to cure. A very desirable leather may also be made by moistening back the dried skins and tanning them in a one-bath chrome liquor. After tanning, the skins may be washed in borax water and then bleached in a warm bath of sumac, dried out and finished in white, or they may be colored any shade of color after the sumac bath.

Good leather can also be made

By drumming the prepared skins in a solution of four pounds of sulphate of alumina and ten pounds of common salt, wheat-flour and egg yolk being omitted. The skins may be drummed in the alum and salt, made into solution with ten gallons of water for one hour. Then, for every hundred pounds of skins in the drum, ten pounds of hyposulphite of soda may be dissolved in six gallons of water and added to the contents of the drum, and the drumming continued for twenty minutes. This serves to make the tawing permanent. To further plump the skins, thinned by the hyposulphite or soda, two pounds more of sulphate of alumina and four pounds of salt may be dissolved and added to the skins, and the drumming continued for one-half hour, after which the skins may be dipped into cold water and finished by

being fat-liquored with an emulsion of soap and oil, or a combination of egg yolk and olive oil, in the same manner as these articles are applied to goat-skins for kid leather. The leather is then dried out and worked soft and is finished. The quantities of egg yolk and olive oil required for one hundred pounds of skins are about ten pints of egg yolk and five pints of olive oil. A good fat-liquor may also be made for this class of stock of five pounds of soap, two gallons of neatsfoot oil and five pounds of egg yolk in twenty gallons of water. The soap should first be boiled into a solution and then the oil added, and the temperature of the emulsion reduced to seventy degrees by the addition of cold water, after which the egg yolk is added. From two to three gallons of this fat-liquor are required by each dozen skins of small and medium size, according to size and thickness and degree of softness wanted by the tanner.

The Napa process, described in another portion of this book, may be used upon calf-skins intended for white leather with good results.

Soft and tough glove leather

May be made from calf-skins by the following process: After the drenching and washing of the raw skins is completed they are treated with a solution, composed for two hundred skins, of the following ingredients: Twenty pounds of salt, thirty pounds of white rock potash, and three hundred gallons of water. The skins may be left in this solution for about two hours, or they may be processed in a drum for thirty minutes, less water being used in the drum method than in the paddle-vat. After this, they are wrung out dry and immersed in a solution composed of twelve pounds of hard soap and two gallons of neatsfoot oil in one hundred and fifty gallons of water. In this solution the skins are left long enough to become thoroughly moistened with it and are then removed and hung up and dried out again. They are treated in this way, wetting in the liquor and

drying out, two or three times. After being treated in this way, they are taken in the dry state and put into clean water and washed in a thorough manner to remove the surplus tanning-matter from them, and in this moist condition are colored any shade desired, or they may be smoked, or dried out without either coloring or smoking, and when this is done they make white leather.

A similar process is the following :

The skins ready for tanning are treated with a liquor composed of two pounds of caustic soda, one pound of borax and enough water to cover the skins; say one hundred gallons. The quantities named are sufficient for one hundred and twenty average size skins. The skins are drummed in this liquor for one-half hour and are then removed and hung up and dried out. The dried skins are next placed in a solution composed of five pounds of hard soap, one gallon of straits-oil, one-half pound of caustic soda and seventy-five gallons of water. In this liquor the skins are left until they have become thoroughly moistened through and soft, after which they are placed in a drum with some of the liquor and drummed therein for one-half hour, being then removed and dried out as before. The skins are next drummed again in some of the second solution, and then hung up and dried out again. Sometimes this process needs to be repeated two or three times until good leather results. They may be colored any shade, or smoked, and will be found to be very soft, tough and strong.

Making glove leather of calfskin fleshers.

For split calf-skin, the grains of which are tanned for shoe leather, good glove leather can be made from the flesh split in the following manner: For two dozen fleshers of average size a solution is prepared of one pound of alum, two gallons of water, one pound of flour, with one gill of oil and enough water to make a total of three gallons of liquor. The skins are drummed in this liquor for one-half hour,

after which they are allowed to drain and are then drummed in a liquor composed of one gill of ammonia, one-half bar of soap, one-half ounce of soda, one-half pound of salt, and about two ounces of ochre, all boiled in two gallons of water until they are dissolved. To this liquor is added one pound of flour, mixed in two gallons of water. The skins are drummed in this liquor for thirty minutes, then dried out, staked and finished upon either side. The flesh sides may be treated in the first liquor and dried out without the use of the second liquor. In the majority of cases it is best to use the entire process, and when finished the skins are very soft and tough and of very fine texture.

A simple method of tanning calf-skins

That results in the making of a leather as soft as chamois, consists of giving the skins a long and thorough liming and a very thorough drenching and washing, draining them and then giving them heavy coats of oil, on both the grain and flesh sides, rolling them up and after letting them lie for a few days, drying them out. The oil may also be applied in a drum. After the skins become dry they should be washed in warm soapsuds, and the suds left in the skins, and the leather dried out again. During the drying the skins should be worked until they become thoroughly soft and dry. The drying of the leather should take place in a moderately warm room, so that they will not be parched, and during the drying they should be worked occasionally so that the drying and softening will be accomplished at the same time. The work may be hastened and better results secured by working the oil into the skins in specially constructed mills.

Essential qualities of glove leather.

The two most essential qualities of glove-leather are softness and strength. Chrome processes are especially adapted to this class of leather, as they make soft tough leather that is comparatively waterproof. To a great extent, the softness of the leather is produced by the nature of the tannage

and the methods used in preparing the skins for tanning. Calf-skins intended for glove-leather are generally more thoroughly limed than skins for shoe purposes. To accomplish the removal of the hair and the preparation of the skins for tanning, limes to which sulphide of sodium or red arsenic had been added are generally used. The results obtained from the use of these two articles are very similar, yet red arsenic is oftentimes preferred to sulphide of sodium when an extra fine grain is wanted. Its use readily removes the hair, also the fine hairs, and leaves the skins with considerable fullness of body and with a smooth elastic grain. When the tanned leather is to be colored fancy shades it is very important that clean soaks and limes be used in order to avoid clouded or mottled grain, which often results when dirty soaks or limes are used. Lightly salted calf-skins need to be soaked only for a few hours, and should be drained well before they are passed into the liming process. Borax, dissolved and added to the water used in these preliminary processes, helps in giving to the skins the smooth and silky feel so much desired. The liming process need not extend over eight days; and considerable lime should be used. The placing of light calf-skins in a very strong fresh lime at the start frequently causes the grain to become loose from the flesh, especially when either sulphide of sodium or red arsenic is mixed with the lime. For convenient handling, the skins are tied together or fastened together with hooks before they go into the limes. Good results are obtained from the use of limes that have been used for previous packs of skins, provided they are kept clean and not allowed to become full of dirt and refuse.

Limes.

A good first lime may consist of two-thirds old lime liquor and one-third new lime, that is, of six feet of lime liquor, four feet may be old and two feet may be new. When it is necessary to prepare a new lime, about one hundred

pounds of lime are slaked in twelve pailfuls of hot water. To this quantity five or six pounds of red arsenic are used. It may be dissolved separately and then mixed with the slaked lime. These quantities are sufficient for five hundred calf-skins to begin with. After being in the lime liquor for one day, the skins should be hauled out and the lime stirred up from the bottom of the vat and the liquor strengthened by the addition of three or four pails of slaked lime. The strength of arsenic limes at the beginning should be about three degrees Twaddle, and by daily additions of lime and arsenic raised up to six degrees. The strength is a somewhat arbitrary matter and may vary considerably and yet produce good results.

Advantages of using sulphide of sodium and red arsenic.

When sulphide of sodium is used, it is used in much the same manner as red arsenic. These chemicals not only shorten the time of liming, but they also keep the grain from becoming rough and by making the lime more soluble, make it easier for the tanner to remove the lime without injury to the skins. To get soft leather, the lime must be gotten entirely rid of before tanning by thorough drenching. Calf-skins, however, are very tender, and require careful treatment during this part of the work. The bran drench has long been used. It gives the skins a smooth soft grain, but is somewhat uncertain in its results. The grain of the skins is often damaged by an undeveloped bran drench, it being very important that the fermentation be fully developed before entering the skins, in order for the drench to do its full work. Lactic acid is used with good results upon this class of leather and, being safe and simple, is a favorite article for the purpose. The method of using it has been fully described in other parts of this work.

Pickling calfskins.

To bleach the skins, to remove the last trace of lime and to get them in such condition that they will tan readily with-

out contraction of the fibres, the skins may be pickled after drenching, in a solution of sulphuric acid, water and salt. This solution may consist of two and one-half quarts of acid and fifty pounds of salt for every one hundred skins. The skins are left in this liquor, with frequent stirring, for six hours, and are then taken out and drained well before they are tanned.

Making calfskin glove leather by a one-bath chrome process.

The best method of tanning the pickled skins with a one-bath process is carried out in the following manner: The skins are drummed for ten minutes in a solution of salt consisting of ten pounds of salt dissolved in five gallons of water for every one hundred pounds of skins. Then they are given a solution of sulphate of alumina and sal-soda, prepared by dissolving, by boiling three pounds of sulphate of alumina in five gallons of water, and three pounds of sal-soda dissolved in five gallons of water, for every one hundred pounds of pickled skins. The two solutions are mixed slowly together and form a milky white liquor. The above liquor should be given to the skins after they have been drummed in the salt water, and drummed therein for at least three-quarters of an hour. Then the concentrated tanning liquor is added to the contents of the drum, a gallon for each hundred pounds of skins at a time, at intervals of one-half hour, and the drumming continued for at least three hours, or until the skins are well struck through with the chrome liquor, after which one-half pound of salts of tartar is dissolved and added to the contents of the drum and the drumming continued for one-half to three-quarters of an hour. This completes the tanning. The skins tanned in this way are of smooth, fine grain and fairly plump. They require a very thorough washing before they are colored, fat-liquored and dried out.

Other processes of chrome tanning.

To tan the calf-skins without first pickling them frequently results in the grain of the leather being somewhat drawn. This is not considered a serious defect, however, on glove leather. Sometimes, too, the drenched skins are first tanned in sulphate of alumina and salt and this is followed by the chrome process. It usually requires about three gallons of concentrated tanning liquor to tan one hundred pounds of skins, although the quantity varies according to the nature of the liquor used. Any of the methods of tanning skins with one bath liquors that have been described, may be used in making calf-skin glove leather; also any of the two bath or acid processes. When the latter are used no previous pickling is required. A good suggestion to follow is to sort the skins before tanning them, into three grades, light, medium and heavy. The first bath of chromic acid is generally applied in a drum and the second bath in a vat. In order to get the colors right and to encounter no trouble with the fatliquoring the skins must be perfectly neutral, free from all acids and salts, before they are colored and greased. Borax is very useful in the washing, as it not only removes the acids and salts but helps to make the skins soft and smooth and thus to take a more even color.

Coloring chrome tanned calfskins for glove leather.

Chrome tanned calf-skins are generally mordanted with liquid extract of fustic or sumac before coloring. About four ounces of these extracts are required for each dozen small light skins. The extract is mixed with about ten gallons of warm water and the leather drummed in the solution for twenty minutes. Then two ounces of either tartar emetic or antimonine for each dozen skins are dissolved in a little water and added to the extract liquor in the drum and the skins drummed for another fifteen minutes, after which they are washed off in warm water and colored.

A very soft and nearly white glove leather may be made by treating the skins to a warm bath of sumac,

And after they come from this liquor pressing out the surplus sumac liquor and fatliquorizing the skins with a mixture of alkaline soap and oil—about ten pounds of the former and four gallons of the latter, boiled in fifty gallons of water. Or the skins may be taken from the sumac liquor and dyed any desired shade, the sumac serving as a mordant. The most common colors wanted on calfskins for glove purposes are yellows, tans, ox blood and olive shades. These are usually applied before the skins are fat-liquored, and drums are generally used for the dyeing, as more uniform results follow their use than any other method of coloring. Practical working directions for dyeing many shades of glove leather will be found in other parts of this work.

An excellent fat-liquor for calf-skin glove-leather is made of ten pounds of potash soap, four gallons of neatsfoot oil, six pounds of egg yolk and six pounds of degrass, completely saponified in forty gallons of water.

Calf-skins are oil tanned and made into exceedingly soft and durable leather,

Very useful in making gloves and mittens. For any process of oil tanning the skins should be very thoroughly limed for eight or ten days in red arsenic limes. After washing and unhairing, the skins should be bated as low and soft as possible. For this purpose a manure bate may be used. It may be used alone or in conjunction with a bran drench or a drench of lactic acid. Any other process of bating or drenching that makes the skins soft and silky may be used. A bran drench, also a lactic acid drench may be used alone. It is very essential that all lime be gotten rid of before the skins are treated with oil. Before the oil is applied, the skins should be thoroughly pressed and as much as possible of the surplus water removed from them. They may then be given a thorough beating by

means of an apparatus or machinery especially designed for the purpose, in order to soften them, after which they are sprinkled with cod oil and are again beaten in order to force the oil into the leather.

Oils used and method of oil-tanning.

The best grade of Newfoundland cod oil is considered the best for the purpose. The process of oiling and beating the skins is repeated two or three times, or until they have assumed a mustard color and have lost their original odor. After the oiling and beating are completed the skins are made to undergo a process of heating. By this process the oxidation of the oil, which was begun during the previous process, is completed by the fermentation that takes place in the skins. The heat is generated spontaneously and the skins must be closely watched, and frequently handled and turned over. The highest temperature allowable is 140 degrees Fah.; a higher temperature than this seriously damages the leather. All organic matter in the skins is destroyed. This process of heating or fermenting is a very delicate one, and upon its being properly done depends the success of the leather.

Unless sufficient heat is generated the skins will rot, and when too much heat is produced, they become dissolved. When the fermentation ceases and the skins are no longer susceptible of heating, they are treated to remove excess of oil. This is done by washing them in hot water and then subjecting them to great pressure by means of a hydraulic press. A great deal of grease is squeezed out in this way, and the grease so produced is known as *degras*. The surplus oil may also be removed by washing the skins in a solution of soda ash which causes the grease to saponify. The saponified oil removed by pressure is neutralized with sulphuric acid and becomes the oil known as *sod oil*. A certain proportion of the oil must, of course, remain in the leather so as to give it softness. The finishing process con-

sists of drying out the skins, working them soft and removing all unevenness and particles of flesh.

Bleaching the skins.

When it is desired to bleach the skins, it may be done by sprinkling them with water and exposing them to the sun, or by treatment with a weak solution of permanganate of potash, followed by a treatment with diluted sulphuric acid, or the leather may be treated with sulphurous acid in the form of gas. The methods followed in handling the skins vary. In some instances the skins are hung up in warm closed rooms, instead of being placed in piles to ferment.

Yellow ochre.

Yellow ochre has been used in the last treatment with oil, and gives to the leather a decided yellow color. The yellow color acquired by the skins, during the treatment with oil, is, however, the only coloring generally required.

Other processes for soft and tough leather.

Very soft tough leather may be made by treating calf-skins with a mixture composed of four pounds of alum, six pounds of salt, twenty pounds of wheat flour, and twelve pounds of egg yolk, thoroughly mingled together in twelve gallons of water, and used for each hundred pounds of skins at a temperature of 90 degrees. The skins are drummed in this mixture for thirty minutes to one hour, and then hung up and dried out. Instead of twelve pounds of egg-yolk, six pounds of the same and six pounds of olive oil may be used. After being left in the dry state for some months to cure, the skins may be worked out soft and finished without further treatment, or they may be washed in warm water and tanned in a one-bath chrome process, and colored and finished as chrome leather. The soluble oils, known as Turkey-red or alizarine oils, may be used with good results in place of the egg-yolk. They may also be used on chrome tanned skins instead of emulsions of soap and oil.

Other oil processes.

Calf-skins may be oil-tanned by being passed through or treated in a drum with a solution of the above named oils. When vats or tubs are used the skins are pressed after bathing and washing, and soaked in a twenty-five per cent. solution of the oil, warm. The oil can also be applied to the skins in a drum. After the treatment with oil the skins are dried out and placed in a heap in a moderately warm room and covered up. They are then hung up in the air and allowed to dry slowly, after which they are treated with the oil in the same manner as at first, being first washed in an alkaline solution. They are then allowed to heat by being placed in piles and covered up, dried again and then washed in a weak solution of borax or other alkali. By drying and working the skins are made very soft and completely oil tanned.

The results may be changed by greater or less concentration of the oil solution, by higher temperatures in drying and by a greater number of applications of the oil. The skins may also be tanned by a combination of the oil with the salts of alumina. The preferred method of doing this is to steep the prepared skins in a solution containing preferably fifteen per cent. of the soluble oil and then drying them out. The operation may be repeated and then the usual method of tanning with alumina salts proceeded with in the ordinary way. Heavy calf-skins are split after liming. The grain is tanned into shoe or fancy leather, and the flesher is made into glove leather. Any process that can be used upon grain skins can be applied to the flesher with equally good results.

Yellow Calf-skin Glove Leather.

Chrome-tanned calf-skins may be colored yellow and finished into glove and mitten leather by the following method :

For each dozen skins of medium size four ounces of Sul-

famine Yellow D are used. The dye is used in solution at a temperature of 130° F. A small quantity of carbonate of ammonia added to the color solution assists in getting the leather penetrated with the dye; but this may be neutralized afterwards by a little acetic acid. A light yellow, of a greenish cast, is obtained by using five ounces of Sulfamine Yellow A.

A good fat-liquor to use upon this class of leather is made of egg-yolk and neatsfoot or olive oil.

CHAPTER XVIII.

TANNING FURS AND HAIR-SKINS.

IN any process of tanning furs and hair-skins, the first thing to be done is a soaking and softening of the raw skins. When the skins are fresh or lightly salted this consumes but a short time, a few hours; but when they are hard and dry a longer time is required. By adding either borax or sal-soda to the water, and by using the water warm, the hardest skins can be thoroughly softened and cleansed in a few hours. After softening, the useless parts of the skins should be removed, and all lumps of fat and flesh removed by fleshing. Then the skins are ready to be tanned. This may be very readily and cheaply done in a solution of salt and alum, although skins tanned in salt and alum gather moisture in damp weather and therefore have unpleasant features. A solution may be made of one-fourth pound of salt, and one-fourth pound of alum, and one-half ounce borax, dissolved in hot water. Sufficient meal may be added to make a thick paste. One way of applying this paste is to spread it evenly over the flesh side of the skins, folding them lengthwise with the fur on the outside and letting them lie for a few days, then to remove the paste, and dry out the skins and work them soft and clean. For heavy skins a second application of the paste may be necessary. The ingredients of the paste may be made into a liquor, and the skins immersed therein, light skins requiring about one day, and heavy skins longer. When they are removed from the liquor the skins should be hung up and dried, and as they dry they should be pulled and stretched by any suitable means until they are both dry and soft. Then they may be cleaned and further softened by a

running in dry saw-dust in a drum especially constructed for the purpose, and then the saw-dust may be removed by running the skins in an open drum, by means of which they are pounded and softened and the saw-dust allowed to fall out. On some classes of skins, such as calf-skins, several days are required in the tanning liquor, and the liquor needs to be strengthened with salt and alum, in the same proportions and quantities as first put in, and after the tanning is completed and before the skins have become quite dry, a coat of mineral oil may be put on the flesh side, and after this has dried in, the skins may be worked and cleaned. Such skins as raccoon, fox, dog, wolf or coyote, and small light skins, such as mink, rabbit and mole-skins, do not require any oil or grease to make them soft. Kangaroo, wombat, deer-skins and calf-skins, however, need the oil in order to make them soft and pliable.

The skins may also be tanned in the following manner ;

Equal parts of borax, saltpetre and glauber salts (sulphate of soda), about one-third of an ounce for each skin, are made with water into a paste, and this is spread over the inside of the skins, more being applied on the thick than on the thin parts. The skins are folded together and left in a cool place for twenty-four hours, then they are scraped and rinsed off and the following mixture applied in the same manner as before : One ounce of either sal-soda or borax, two ounces of hard white soap, melted slowly together without being allowed to boil. The skins are left with this mixture upon them for twenty-four hours. After this they are put into a solution composed of three ounces of alum, six ounces of salt, dissolved in sufficient hot water to cover the skins. When this liquor is cooled down to ninety degrees, the skins may be immersed therein for twelve hours, after which they are wrung out and dried. The skins may require to be put back in the liquor for a few hours longer, depending upon their condition. The

flesh side after drying may be cleaned and made smooth with sandpaper or pumice stone.

The ingredients of the paste may be made into a liquor and used warm, and the skins left therein for twenty-four hours. This method of tanning makes the skins very soft, the hair is finely set, and has a peculiar gloss that is especially desirable.

This method also produces good results.

Bran and soft water are well mixed together. The skins are immersed in the liquor for twenty-four hours, then they are removed and placed in a liquor made up of one pound of alum and one-half pound of salt in two gallons of hot water. When this is cooled down, the skins are put in and left therein for twenty-four hours. They may be given an additional liquor of oatmeal and warm water, after which they are wrung out and dried. This leaves the skins white and soft and ready for immediate use.

A good tanning mixture is made of salt, alum and sulphuric or muriatic acid in proportion of one pound of salt, two pounds of alum and one-half pint acid for about fifty skins, such as raccoon and wombat, or five to ten calf-skins. The skins are left in this liquor, being occasionally stirred about for two or three days, when they are removed, partly dried and shaved or cut down to a satisfactory thickness. Then they may be put back into a liquor prepared as the first for another day, then dried out, oiled and worked soft. A mixture of soap and oil may be used to grease the skins, or oil may be used alone.

A process for hair skins and hides for robes.

Hides for robes and all classes of hair skins may be nicely tanned in a liquor composed of one part alum, one part salt, one-quarter to one-half part japonica, gambier or other tanning material. These are dissolved in hot water in sufficient quantity to make a thirty-five degree liquor. Hides require to be left in this liquor from five to ten days.

Skins are finished in from two to three days. In tanning hides for robes or coats, shaving or dressing down is an important part of the process. Before this is done, the hides should be partly dried, and after shaving they should be put back into the tan liquor for a day or two, then hung up and dried out. After drying they should be moistened back and given a heavy coat of oil. Soap is also sometimes used. After drying the second time the hides or skins should be worked soft and run in a drum or wheel until thoroughly soft and clean. The composition of the tanning liquor may be changed considerably. The use of japonica makes the hides more capable of resisting water, as the alum and salt are readily soaked out by rain. In tanning calf-skins and other skins in the hair, the tan liquor acts only upon the flesh side, and the hair will consequently be apt to slip before the tan reaches the roots. All unnecessary handling should be avoided and the tanning done as rapidly as possible so as to give the hair no chance to fall out. The hair may be readily set by leaving the skins for a few hours in a strong alum and salt liquor, before they are placed in the other tanning material, japonica or whatever may be used. A mixture of hemlock and quebracho extracts may be used ; also palmetto extract either alone or in combination with other tannages. The application of oil or grease can only be done upon the grain side, and after the skins have been dried out and moistened back. Warm soapsuds are used, also a mixture of oil and soap, made up of ten pounds of potash soft soap and four gallons of cod, sod or neatsfoot oil, boiled together into an emulsion, after which water is run in to make a total of twenty-five gallons. The softening and cleaning of the hides or skins is best done in specially constructed drums or wheels, in which the hides or skins are milled in clear dry sawdust, and the sawdust then cleaned out of the hair in an open wheel or drum.

Dry hides and skins may be softened in a solution of sulphuric acid and water, until they are swollen and plumped.

Then the acid may be neutralized by a soda or borax bath ; the swelling is also reduced. The soda or borax may then be removed by washing in clear water.

In using a gambier or other similar liquor in tanning furs and hair-skins, the skins should first be soaked soft and clean and then fleshed. A gambier liquor of about three degrees strength may be used at the start ; the skins handled every two or three hours until the strength is reduced to one degree. Then a six degree liquor may be used, and in about forty-eight hours the skins will be tanned. Heavy skins require more time. It is also a good plan to leave the skins in a strong alum and salt liquor for an hour or two before tanning them with gambier, as this serves to set the hair firmly. When the skins are fully tanned they should be dried out and worked soft and clean ; then a mixture of oil and soap may be applied, made up of one and one-fourth pound of castile soap, dissolved in one quart of water, and mixed with one pint of paraffine oil. Other oils may be used alone and the soap omitted, very little oil being required to make the skins soft.

THE TANNING OF HIDES FOR ROBES, COATS, ETC.

Hides intended to be tanned with the hair upon them, and used in the manufacture of coats and robes, should be soaked in fresh water before they are tanned, in order to rid them of dirt, blood and other undesirable substances adhering to them. They should be soaked long enough to become thoroughly softened, the length of time varying from twelve to twenty-four hours. Dry hides are much more difficult to soften than salted ones. Borax is useful in softening dry hides, also a strong solution of salt and water. When borax is used, from five to six pounds are dissolved in hot water and poured into the water to be used for soaking and vigorously stirred throughout the same, the quantity of borax mentioned being enough for one thousand gallons of water. The effectiveness of the

borax soak is increased when the temperature of the same is raised with steam to about ninety degrees Fah. The hides may be left in the soak for twelve hours and should then be worked upon the beam or milled in a drum in a solution of borax and water, or they may be softened in a hide mill. After the milling, the hides require further soaking in the vats according to their condition. When a salt solution is used, it should be made up in a vat and sufficient salt should be used to make the liquor decidedly salty. The hides may be left in the brine for from twelve to twenty-four hours, then milled in a pin-mill drum in a salt solution for thirty minutes, and then put back into the brine for another twelve or twenty-four hours. This method of softening is very satisfactory. After the soaking is completed, the hides should be fleshed and all flesh and lumps of fat removed from them before they are tanned.

Sometimes hides are received by tanners in a partially tanned condition, that is, some one has attempted to tan the hides without sufficient knowledge or without the facilities necessary to do the work. In order to soften and cleanse such hides so that they can be readily tanned and finished, they should be placed in a pin-mill drum with either a borax solution or a solution of salt and water and milled in the same until sufficiently softened. The hides must be watched, however, to see that the hair does not become loosened by the violent treatment in the mill. There are various ways of tanning hides with the hair on. A very common method is by the use of alum and salt. This is really more of a curing than a tanning process. While the hides can be made very soft and strong by the use of alum and salt, they have one very objectionable feature. They gather moisture and become heavy and damp in moist weather.

Alum and salt process.

In applying the alum and salt process, the hides are

taken after being fleshed, and are immersed in a fairly strong solution of alum and salt, care being taken to expose all parts of the flesh side to the liquor so that the hair roots may become firmly fixed and hair slipping avoided. The hides should be given plenty of room in the liquor, so that they can be handled about, once in a while and their positions changed. It is good practice to hang the hides upon sticks and suspend them in the liquor. The strength of the alum and salt solution is a matter of judgment. The stronger it is, the more readily it will penetrate into the hides and the less will be the time consumed by the process. Perhaps as good a rule to follow as any is to use twice as much salt as alum. Hides may be well struck through with a liquor made up of six pounds of alum and twelve pounds of salt for each one hundred pounds of hides to be tanned. The hides should be left in the liquor until they have become permeated with it, the length of time required to accomplish this depending upon the thickness of the hides and the strength of alum and salt liquor, after which they should be soaked for ten minutes in clean cold water, drained and hung up to dry. When they have become about two-thirds dry they should be laid in piles for a few days to become uniformly soft and moist, before they are dressed down to the desired substance. While they are lying in piles they must be watched and occasionally handled, especially in warm weather, to prevent heating, which always causes more or less damage, according to the degree of heat developed.

The dressing or cutting down to a light substance is generally done by hand. This work requires considerable skill and judgment in order that the hide may be smooth and of even thickness and free from holes. After the hides have been cut or dressed down, it is necessary to retan them. This may be done in various ways. The hides may be placed back in the alum and salt solution; they may be retanned with alum and salt in a pin-mill drum; sulphate

of alumina and salt, followed by a treatment with hyposulphite of soda, may be used ; and the retanning may also be done in pin-mill drums with a solution of gambier and salt, or a combination of quebracho and hemlock liquors. Quebracho extract being a good tanner and making soft stock, may be used alone.

A good method of retanning the hides

Is to place them in a pin-mill drum with a solution of sulphate of alumina and salt, made up in the proportions of four pounds of the alumina and eight pounds of salt, dissolved, and mixed into twenty gallons of water for every one hundred pounds of hides. In this solution the hides may be drummed from thirty minutes to one hour. Then for every one hundred pounds of stock in the drum ten pounds of hyposulphite of soda may be dissolved in five gallons of warm water and added to the contents of the drum. A further drumming for thirty minutes completes the process, and secures a permanent fixation of the tanning materials upon the fibres of the hides. Taken from the drum the hides should be dipped singly into cold water to remove surplus tanning materials, drained, hung up and dried. When they are nearly dry and yet retaining some moisture, they should be stuffed with oil or grease and then dried thoroughly, after which they require thorough working to regain their softness lost during drying, and also a thorough cleaning in dry sawdust. By a retannage of gambier and salt, the unpleasant features of alum-tanned stock are prevented, and the hides made permanently soft and strong. The gambier and salt liquor may be applied to the hides either in drums or in vats, the process being carried along until the liquor has thoroughly permeated the hides, then they may be left in piles for forty-eight hours, drained well and hung up to dry.

A combination liquor of quebracho and hemlock extract

Produces good results. About two-thirds of the liquor

should be quebracho and one-third should be hemlock ; one supplements the other. A weak solution of quebracho extract may be used alone. These vegetable tanning materials may be used in drums or vats.

Softening the stock.

For the purpose of imparting softness to the stock oils of various descriptions may be used, also combinations of tallow, soap and oil. Fish oils are very satisfactory, but somewhat too expensive. Mineral oils of good quality produce good results. A heavy coat of the oil should be given to the hides upon the flesh side. Any excess of water should be guarded against in the hides, as this prevents the proper absorption of the oil. The oil should be allowed to penetrate into the hides by slow drying after which the stock should be left in the dry condition for some time before it is finished. The longer the hides are kept in the dry condition, the softer they will be when they are finally finished.

The softening and cleaning of the hides is best accomplished in revolving mills or drums especially constructed for the purpose. The oil, grease and dirt are taken up by dry sawdust in a closed drum, and in an open drum the sawdust carrying the oil and grease with it, is cleaned out of the stock. The cleaning process needs to be repeated two or three times to get the stock perfectly clean and soft.

Calf-skins and other hair skins may be tanned in the manners suggested for heavy hides. In the case of alum-tanned stock, some yellow ochre may be added to the sawdust and gives to the flesh side a desirable yellow color.

Dyeing with Ursol dyes.

Hair skins and hides, after cleaning and softening, may be readily colored by the use of the dyes known as Ursol colors, made in Germany. Ursol D, used with bichromate of potash as a mordant, produces black. The dyeing is best done by brushing the dye solution into the hair until

it becomes saturated with the liquor. When dried out, the color of the hair will be black through and through. Sometimes more than one application of the dye is required to get the right shade. Ursol dyes are not difficult to use. Any tanner, by close attention and study, can soon learn to get just the results he desires with them. The hair must be free from grease, clean and dry, and by a process of "killing," prepared to receive the dye. To accomplish these results, a compound of sal-ammoniac, sulphate of alumina and lime may be used, the lime being the milk of lime, obtained by slaking common white lime with hot water. The solution prepared of these ingredients is applied to the hair with brushes, after which the hide or skin is dried in a cool, shady place; and then cleaned by thorough dusting and beating and is then ready for the color solution. Ursol dyes are used in different ways and in varying combinations. In some cases no mordanting of the hair is necessary, in others a solution of bichromate of potash and cream of tartar is used, not only to serve as a mordant for the dye, but to reduce the quantity of coloring material required. Sulphate of iron and sulphate of copper may also be used as mordants. The skins may be immersed in the mordanting liquor, and left therein from six to twelve hours, then washed off and dyed.

Ursol D, for black dyeing, is used in combination with peroxide of hydrogen, and water. The dye liquor can be used very liberally upon the hair side only, and should be well brushed into the hair so as to dye the entire hair. The hair can also be merely tipped with the dye liquor, when tip dyeing is considered all that is necessary.

The proportions of the mordanting materials may be: One ounce of bichromate of potash, one-half ounce cream of tartar in twelve quarts of water. Of the dye liquor—one ounce Ursol D, three pints of peroxide of hydrogen, and twelve quarts of water. After the dyeing materials become dry the hides and skins should be thoroughly washed, dried and cleaned.

CHAPTER XIX.

KANGAROO LEATHER.

THE skin of the kangaroo is characterized by great suppleness, toughness of fibre, and by a grain several times thicker than the grain of any other kind of skin. The grain, after tanning, is also very compact, and resists the penetration of water and moisture. On account of these peculiarities kangaroo leather is splendid shoe material, standing in a class by itself, and especially adapted for shoes for tender feet. At the present time kangaroo leather is made by chrome, gambier and similar tannages, and by combinations of chrome and vegetable processes; and is finished in a number of ways, dull, bright glazed, half bright, patent and enamelled.

The skins are received by the tanner in dry condition, having been dried as soon as taken from the animal, to prevent spoiling. They are very hard and dry and almost waterproof, resisting the penetration of water to an unusual degree. Clear water softens the skins very slowly. It is therefore good practice to hasten the soaking and softening by the addition of solutions of chemicals to the water, before the skins are put in. Borax and sulphide of sodium have proved very satisfactory for this purpose. When borax is used, five pounds are enough for one thousand gallons of water, dissolved in a pail and poured into the soak vat and vigorously stirred. Borax thoroughly softens the water, and helps in giving the skins a soft, silky grain.

Softening the skins.

When sulphide of sodium is used one or two pounds may be added to every one hundred gallons of water. Soak

water prepared with sulphide of sodium readily softens the hardest skins and brings them back to the natural soft condition in a short time, also freshening up the dried and withered grain.

The skins may also be softened in a strong brine or solution of salt and water. This readily penetrates the skins and opens them out. The salt water should be removed by washing in clean water, before the skins are further treated.

When any of these articles are used to assist in the softening it is seldom necessary to mill the skins in the hide-mill. If the skins soften slowly they may be taken out of the water at the end of say twenty-four hours and worked in the mill, or drummed in pin-mill drums for a few minutes and then put back in the vat until they are thoroughly soft and supple. It is not best to use foul soaks, that is soaks in which previous packs of skins have been soaked. Dried skins become soft in such soaks in a very short time, but often at the expense of some important quality of the leather, that does not show until after the skins are tanned and perhaps not until they are finished, and then no one can tell what was the cause.

Depilating.

After soaking, the skins should be drained, and then fleshed and lumps of fat and flesh removed from them. Then they are ready for the process of depilating. This may be carried out in a number of ways. If it is not desired to save the hair, a vat may be filled with water, and for every one hundred gallons of water in the vat from ten to fifteen pounds of sulphide of sodium and a few pailfuls of lime added. The sulphide of sodium should be thoroughly dissolved, and the liquor well stirred, then the skins put in. In from twenty-four to forty-eight hours the hair will become dissolved sufficiently to allow it to be readily washed off. After this the skins may be very lightly limed for a few days. When this method of unhairing is used,

the skins need not be soft before they are put in the liquor, but may be left in until they are soft and plump. The skins should not be allowed to dry out nor harden, and must be entirely soft and plump before they are placed in the lime. Very little lime is needed. About two buckets of lime are slacked in one-third of a barrel of water. This is put into sufficient water and will answer for three hundred skins. The skins should be left in this lime for one day, then taken out and the liquor strengthened up with the same quantity of lime that was put in at the first. Before the skins are put back the lime should be thoroughly stirred up from the bottom of the vat. On the third day the skins should be again pulled out, the lime strengthened, and the skins put back. Or the skins may be reeled from one lime to another each day; the first lime being rather weak, and the second, third and fourth limes of gradually increasing strength. Four to five days in the liming process is generally enough for ordinary skins. Very heavy skins may be limed for six or eight days. After a pack of skins is limed, the liquor may be used for another lot of skins by running out about one-half of the liquor and replacing it with water, and the work proceeded with as before.

Kangaroo skins limed in arsenic limes.

Kangaroo skins are also very satisfactorily prepared for tanning by the use of limes to which red arsenic has been added. The skins, owing to their tough and compact grain, are not readily injured by strong liquors, and the process can be completed in a few days. The use of red arsenic in connection with lime makes the grain fine and soft, and shortens the time of liming. The arsenic limes may be used over and over as long as they are clean. When old lime liquor is to be had, a good first lime may be prepared by using two-thirds old liquor in the vat, and one-third new and fresh. In making the new liquor about one-

eighth of the weight of the skins, of lime may be used, and about two per cent. of the weight of the skins, of red arsenic—that is, for one hundred pounds of dry skins, a little more than twelve pounds of lime may be used, and two pounds of red arsenic, thoroughly slacked together with hot water.

A good strength of lime liquor to commence the process with is about three degrees, Twaddle, and by the addition of lime and arsenic the strength may be raised towards the end of the process to six or seven degrees. No hard or fixed rule can be followed. The tanner must determine by close observation just how much lime to use, and how long to leave the skins in the lime.

For the chrome tannage, a short quick liming produces the best results, as the skins are kept full and plump, and not allowed to lose any of their substance. After the hair becomes loosened it is well to leave the skins a day or two longer in the limes, as this enables the hair to come off more readily and cleanly, and makes softer leather.

When paddle-vats are used it is not necessary to pull the skins out each day, although it is a good plan to stir the lime up occasionally. Sulphide of sodium is used with lime in much the same manner that red arsenic is used. These chemicals shorten the time of liming; keep the grain from becoming rough; make it close and firm; toughen the leather, and by making the lime more soluble make it easier for the tanner to remove it before tanning the skins.

Bating.

The skins are next unhaired and fleshed. Then they are washed and bated or drenched. Bating with manures, which is so risky and uncertain, is being gradually superseded by other methods that remove the lime from the skins and prepare them for tanning without the unpleasant features of the older method. To keep the skins full and plump and without any loss of substance or strength results in full, plump and tough leather. Various methods of bat-

iug and drenching have been described in the chapters on goat and sheepskins. Kangaroo skins may be treated with any of the described methods, so it is not necessary to repeat the descriptions here. Manures may be used alone, or in connection with lactic acid (see *Goatskins*); bran may be used, also lactic acid, the latter material being the cleanest and most satisfactory article a tanner can use. In order to get good and rapid tannage, and bright grain on the leather, it is necessary to have the skins perfectly free from lime and dirt. Very good leather is made from kangaroo skins by the use of the gambier tannage. This may be used alone or in conjunction with alum and salt, making a dongola process. Palmetto extract is a new tanning material. It is a perfect substitute for gambier and costs less. It makes soft tough leather in a short time, being a more rapid tanner than gambier. It may be used alone, with good results, or used in connection with a chrome process.

Gambier process.

When gambier is used alone, some salt is added to the liquor; and the skins are started in a weak liquor, which is gradually strengthened by the addition of fresh gambier until the skins are tanned through. The use of the paddles causes the skins to be turned over in the liquor, and by changing their position insures uniform tanning. The use of salt keeps the liquors sweet and hastens the tanning. After the tanning in gambier is completed the leather may be strengthened and cleared by being drummed in a solution of alum and salt. This liquor may be composed of seven pounds of alum and five pounds of salt for every two hundred medium size skins. A drumming in this solution for thirty minutes will accomplish the desired result. The leather should then be washed, pressed and left in piles for forty-eight hours, then fat-liquored and dried out. When palmetto extract is used, the skins are taken after bating and washing and are put into a cold palmetto liquor of

about eight degrees Barkometer strength, and reeled therein for one-half hour. Then they are tanned in a drum with palmetto extract made up in a liquor of 30° Béaume, or 51 Twaddle, at a temperature of 75° Fah. For three hundred and fifty pounds of skins, weighed as they come from the beam-house, two hundred and twenty-five pounds extract may be used in the wheel. A drumming of four to six hours ordinarily completes the tanning. Heavy skins may require to be shaved and then retanned, which can be done by drumming them for one hour in a liquor of 30° Béaume, 51 Twaddle.

After the tanning or the retanning is completed, the leather should be washed in lukewarm water. The water in which the leather is washed may be used for coloring a fresh lot of skins as they come from the bean-house. After being washed, the leather should be pressed and then fat-liquored. A suitable drum is heated to a temperature of 140° F. and two hundred and twenty pounds of pressed leather are put into the drum. A fat-liquor for this quantity of leather may be made of two and one-half pounds of soap, and one-half gallon of degreas, thoroughly boiled together and used at a temperature of 120° F. The leather should be drummed in the fat-liquor for one-half hour, then it should be washed off, struck out, and hung up and dried out. After drying it may be finished in any desired manner.

Combination process.

Combination-tanned leather may be made with palmetto extract combined with a chrome process. Skins that have been tanned with a two-bath chrome may be lightly retanned with palmetto. When a one-bath chrome process is used, the skins may be well struck with the chrome liquor and then finished up in palmetto, or the process may be reversed, the skins being first tanned in palmetto liquor, made up of three gallons of the extract, and one pint of glycerine in one barrel of water, at a temperature of 75° F. and afterwards in the chrome liquor.

Straight palmetto tanned leather, also combination tanned stock, can be readily colored any shade or dyed black.

The tanner of kangaroo skins will find in the chapter on calf-skin tanning some interesting information regarding various methods of tanning that are well adapted to kangaroo leather.

Kangaroo leather of remarkably fine texture,

Full plump body and smooth fine grain, may be made by tanning the skins in a combination of alum and chrome processes. To get the best results from this method of tanning, the skins should be thoroughly and well limed, and then bated and drenched until they are perfectly neutral and clean, so as to get the necessary softness and pliability. No pickling is necessary, the skins being treated directly with the alum process. A solution is made consisting of nine pounds of alum, four or five pounds of common salt, and thirty pounds of wheat flour, dissolved in hot water, and then mixed into about twelve gallons of water, lukewarm. To the liquor thus prepared about twelve pounds of egg-yolk are added, and the whole vigorously stirred for a few minutes. The washed and cleaned skins are put into a suitable drum, with the tanning combination at a temperature of about ninety degrees, the drum set in motion, the skins drummed for at least one hour for light and medium skins, and two hours for heavy skins. At the end of this time the skins should have absorbed all the tanning ingredients. They may then be removed from the drum, hung up and dried out. After becoming dry they should lie for some time before the remaining operations are carried out. These operations consist of moistening back the dry skins, until they are uniformly soft and moist, which can readily be done by drumming them in a very little warm water. Then they are tanned with a one-bath chrome liquor, and rendered insoluble and possessing all the good qualities of chrome leather. About two and

one-half gallons of concentrated liquor are sufficient for one hundred pounds of leather, and a drumming for three hours completes the tanning. This, of course, is followed by washing, striking out or pressing and shaving, after which the leather may be colored.

One-bath chrome process.

Good plump leather is made by tanning the skins in a one-bath chrome process, carried out as follows: For every one hundred pounds of skins weighed as they come from the wash-wheels, three pounds of sulphate of alumina, and six pounds of salt, are dissolved in ten gallons of warm water and the skins drummed in this liquor for at least thirty minutes. Then the concentrated chrome liquor is added to the skins, in quantity about three gallons for every one hundred pounds of skins in the drum, and the stock drummed therein for at least three hours, at the end of which time the skins will be found to be leathered and may then be removed, and after draining for some hours, or over night, may be washed in warm borax water for twenty minutes, and in clean water for at least fifteen minutes longer.

When a paddle vat is used for the process the skins may be pickled in alum and salt as above described, or they may be entered at once into the tanning bath. The liquor is somewhat weak at the start and is gradually strengthened as the skins absorb the tanning material from the solution. The paddle method consumes from two to three days according to the strength of the liquor and the thickness of the skins. Enough tanning material should be used to enable the skins to grow into plump and lively leather, and sufficient salt used to prevent the drawing or contraction of the fibres.

Other one-bath processes.

There are other methods of tanning the skins in one-bath processes, the following being a very good one. After drenching the skins are pickled in sulphuric acid, salt and

water: Fifty pounds of salt and two and one-half quarts of acid are used for each one hundred and fifty skins. The skins are stirred about in this liquor for about six hours, and are then allowed to drain well before they are tanned. When they are to be tanned they are weighed and for each one hundred pounds of skins ten pounds of salt are dissolved in five gallons of water and the skins drummed in this salt solution for ten minutes. Then a solution that has been previously prepared is poured into the drum and the skins drummed for three quarters of an hour. This solution is composed of three pounds of sulphate of alumina dissolved by boiling in five gallons of water, and three pounds of sal-soda dissolved by boiling in five gallons of water. Then the soda solution is slowly poured into the alumina and the combined milky liquor that results is used as above suggested. At the end of three quarters of an hour one gallon of tanning liquor is added to the contents of the drum for every one hundred pounds of skins and the stock drummed one-half hour, then another gallon of tanning liquor is added, and the drumming continued for one hour; then another gallon of liquor is given the skins and the drumming continued for another hour. At the end of this time the stock will be struck through. Then for every hundred weight of stock one pound of salts of tartar is dissolved in a little water, and this is poured into the drum and the drum run for another one-half hour. This should complete the tanning. Skins tanned in this way require a very thorough washing before they are colored, dried out or finished.

When the two-bath process is used about five pounds of bi-chromate of potash and two and one-half pounds of muriatic acid, in about twelve gallons of water for each one hundred pounds of skins, constitute the first bath. In this liquor the skins are milled in the drum until the yellow liquor has penetrated the thickest skin. Chromic acid may be used in quantity about five pounds for every hundred

pounds of skins, without the muriatic acid. Some salt should be added to the chrome liquor. It seems not only to plump the skins somehow, but to make the leather softer. The drumming of the first bath must be continued until the thickest skins are impregnated with the liquor, the time being determined by the thickness.

Carelessness in this respect results in poor leather. When the process is completed the skins are taken out of the drum and struck out or pressed, and the surplus liquor removed from them. They should then be left in piles for a number of hours before they are placed in the second bath. For the second bath a paddle vat should be used. Sufficient water to cover the skins is run in, and for every one hundred pounds of skins, fifteen pounds of hypo-sulphite of soda are dissolved and poured into the vat. To this are added three pounds of muriatic acid. The addition of the last article causes sulphurous acid to be evolved, which is the active agent of the bath. The pressed skins from the first bath may be dipped singly into a weak hyposulphite of soda and muriatic liquor before they are put into the main liquor. By means of this a slight surface reduction is accomplished. By the action of the paddles the liquor is constantly stirred, and the skins kept in motion. As soon as the yellow liquor has entirely disappeared, and the skins have assumed a uniform greenish blue color through the thickest parts, the skins may be removed from the liquor. This completes the tanning, unless it is desired to give the leather a gambier or similar bath, in which case the skins may be washed and given the vegetable tannage. The use of a vegetable tannage in connection with chrome, causes the leather to be more porous and open grained than would otherwise be the case.

Blackening chrome-tanned kangaroo leather.

When the grain side of chrome-tanned kangaroo leather is blacked, it is customary to first color the flesh side blue

or purple, thus improving the appearance of the leather as well as serving as a base or foundation for the black on the grain. After washing, striking out or pressing and shaving the skins are put into a drum with a solution of logwood, blue nigrosine and sal-soda, or the blue nigrosine is used alone as may be preferred. Purple anilines are also used, but are somewhat costly and do not produce as clean color as the nigrosine or logwood. Hemolin is a form of logwood possessing superior qualities. To obtain the blue flesh and black grain, five pounds of Hemolin with a small quantity of borax or sal-soda are boiled for a few minutes in fifty gallons of water. The skins are run in this liquor in the drum until the color is well taken up and are then spread on a table and a striker applied to the grain; the result being blue flesh and black grain. Blue nigrosine is used as follows: The water should be heated to a temperature of one hundred and twenty degrees. For each dozen skins of medium size, three ounces of nigrosine are dissolved in three gallons of the hot water, and the skins drummed in the solution for twenty minutes. The water is then drained off, the leather struck out or pressed and is then ready for fat-liquoring and grain blacking.

A good striker.

A good striker to develop the black on the grain is made of four and one-half pounds of copperas, and one and one-half pounds of blue vitriol dissolved by boiling in a half barrel of water. Then are added one and one-half pounds of nut-galls, and one pound epsom salts. The leather may be grain blacked in drums, on a machine or by hand on tables, or by the use of trays or dye-boxes. It is generally⁴ the custom to dye the grain black after the leather has been fat-liquored, and the method of dyeing in boxes is the preferred one.

Owing to the great suppleness of kangaroo skins, they do not require so much grease as some classes of skins, to im-

part to them the desired softness and strength. It is poor economy to use a cheap grade of oil, as often leather treated with such oil has a disagreeable odor. Only the best highest refined and lowest test oil should be used, the extra cost over poor oil being made up by the finer feel which the good oil imparts to the leather. A good fat-liquor for kangaroo leather is prepared in the following manner: Ten pounds of potash soap are boiled with steam in ten gallons of water until all is dissolved. Then four gallons of neats-foot oil are cut with a few ounces of dissolved borax or sal-soda, and poured into the soap solution, and the mixture stirred very thoroughly. Then enough water is run into the barrel to make forty gallons of fat-liquor, after which are added ten pounds of egg-yolk and one pound of salt. For heavy skins five pounds of French degreas are added, and egg-yolk omitted or reduced in quantity. This fat-liquor may be used at temperatures varying from one hundred and twenty to one hundred and forty degrees. The quantity required by a lot of leather depends upon the degree of softness desired, and must be decided by the operator. Two gallons and more are usually required by a dozen skins.

If the leather is not to be grain blacked in drums, but by hand or in dye boxes it need not be done until after fat-liquoring. Then, after dyeing, the skins are washed off with warm water and struck out on the grain and a light coat of glycerine applied with a sponge evenly over the grain. After this the skins may be laid in piles for one or two hours and then again struck out, and all wrinkles removed, and the grain lightly oiled. Then the skins are dried out either by being hung up in a warm room, or they are tacked on boards or stretched in frames, then moistened, staked, dried again, and if they require it, staked again. Then they are ready for the final finishing. For a glazed finish the grain may be cleared of grease by an application of a dilute solution of lactic acid, well rubbed in and dried. This is followed by a seasoning fluid, which requires to be

well rubbed into the grain, dried in a warm room, and the leather glazed. The smaller the quantity of seasoning liquor used to get a clear bright finish the better the finish will be, as it will stand handling and wetting better. Two and even three coats of seasoning are usually required. For a dull finish the leather is dressed with a dull seasoning, dried, and before it is entirely dry it is rolled or ironed, and the process is completed.

For the preparation of chrome-tanned kangaroo leather, to receive any shade of color or black a preliminary preparation with tanning extracts is an advantage, and for fancy shades is the most practical method of mordanting the skins so that they will take any dye. Sumac is used alone, also in combination with gambier.

Sumac treatment.

A most satisfactory method of treating the chrome-tanned skin for black, is to treat the skins in a bath of sumac, carried out in the following manner: For one hundred pounds of leather, weighed after shaving, a solution of sumac is prepared—four pounds of extract of sumac and three gallons of warm water, thoroughly mixed together and then mixed into thirty gallons of water, of about one hundred degrees Fah. The skins are drummed in this solution for thirty minutes, and are then rinsed off and stained upon the flesh, with a blue or purple dye. Instead of sumac extract, a fresh infusion of sumac leaves may be used; and the sumac may be replaced with gambier, about two-thirds of the liquor being made of gambier and the other one-third of sumac.

Palmetto treatment.

Also, in place of either sumac or gambier, a liquor of palmetto extract serves as an excellent preparation for either black or colors. After the skins have been prepared with any of the named articles, a very desirable blue flesh is obtained by the use of a methyl violet aniline, about

three ounces per dozen skins producing good results. Blue nigrosine may also be used upon skins so prepared in quantity, about three ounces for each dozen skins, dissolved in five gallons of hot water. Logwood and borax also produce a very pretty flesh color—one pound of logwood in powder form and a few ounces of borax being required for one hundred pounds of skins. Leather treated in any of these ways, and subsequently blacked upon the grain, dries out and finishes up a perfect black ; the grain is made more durable and of finer texture.

Treatment of Gambier, Palmetto, and combination tanned kangaroo leather after tanning.

As soon as the tanning, and in the case of very heavy skins the retanning is completed, the skins are removed from the tanning liquor, and pressed to remove the surplus liquor, and then left in piles for a number of hours. Very good results follow the application of fat-liquors, used in these classes of leather in the same manner as upon chrome leather. A suitable pin-mill drum should be heated to a temperature of one hundred degrees, and one gallon of oil used for each one hundred and fifty pounds of leather, weighed after being drained and pressed. The skins are run in the oil until the oil is all absorbed, then they are taken from the drum and hung up and dried. After drying, the leather should be weighed and then dampened in a tub and piled up for a number of hours to soften. This moistening and softening must be uniform. The drum is again heated to one hundred and twenty degrees, and the leather put in with just enough water to soften all parts alike. The moisture must be uniformly distributed, and the leather full. The fat-liquor will then be evenly and rapidly absorbed. All excess of moisture must be guarded against, and any surplus water drained off. The fat-liquor should be added to the leather through the gudgeon while the drum is in motion. The temperature should not exceed

one hundred and twenty-five degrees. The quantity of fat-liquor required by a lot of leather depends to some extent upon the tannage and upon the degree of softness desired. Some tannages require more grease than others. The leather should be drummed in the fat-liquor until all the grease is taken up, then it should be hung up and dried out again. A very good fat-liquor is made as follows: About twenty-five gallons of water are put into a barrel. To this are added twenty-five pounds of soap, the whole boiled until thoroughly dissolved. Then about fifty pounds of English sod oil and one and one-half gallons of neats-foot oil are poured in and the mixture thoroughly stirred until the ingredients are well mixed together. Enough water is next added to make fifty gallons of fat-liquor. After the process of fat-liquoring is completed the leather should be taken from the drum and washed in warm water to free it from particles of leather fibre, etc., and then hung over horses for a few hours in order to allow the fatty matter to assimilate with the fibres of the leather while it is warm and before it is dried out. The leather is next dried out again.

When the leather is to be colored yellow on the flesh side it is taken, after fat-liquoring and drying out, and thoroughly moistened in a tub of warm water and left in piles for twenty-four hours to soften. A solution is then prepared, of sumac, of which one-half pail is scalded for two hours in a closed vessel. To this are added four pails of water, and one gallon of Lactracine. This quantity of prepared liquor is sufficient for from one hundred to one hundred and thirty kangaroo skins according to their size. The temperature should be one hundred degrees Fah., and the stock drummed in the liquor for twenty-five minutes. Then the skins should be thrown back upon the sides of the drum and the yellow color liquor prepared and added. This may consist of one pound of Yellow S dissolved in one-half barrel of water. After the leather has been drummed the

required length of time three pailfuls of this color are added for each one hundred pounds of stock weighed in the dry condition. A drumming for ten minutes is sufficient to allow the leather to absorb the dye. Then the stock is rinsed off, dyed black on the grain with Hemolin or some other form of logwood and black striker, set well out on the grain, and oiled lightly, dried out, staked and finished in the usual way.

When a blue or purple back is wanted on the leather, the skins are dried out after fat-liquoring, moistened and softened as above suggested and colored with a solution of logwood and sal-soda. Blue nigrosine may also be used in the same manner as described for chrome tanned skins; and after the flesh is colored blue the grain is blacked with logwood and iron striker.

After the leather is dried out, it is dampened, staked, seasoned and finished in either dull, half-bright or bright glazed as may be wanted. A good seasoning for this class of stock that produces a very bright finish is composed of blue stone, iron, logwood, ammonia, blood and nigrosine, in the following proportions: Blue stone, one-half pint; iron, one-eighth ounce; logwood, one-half pint; blood, one pint; migrosine, one-half pint. This seasoning is applied evenly to the grain of the leather and well rubbed in, then the leather is dried in a warm room, and glazed, after which it is staked on the machine, and again seasoned and glazed. Two or three applications of the seasoning liquor, followed each time by glazing, are generally required before a good clear and bright finish is obtained.

For dull finish the leather is seasoned with a dull dressing and while it is moist, it is ironed either by hand or on a machine. For fancy shades of leather, the stock after being drummed in the sumac liquor, as described for yellow back, may be treated with solutions of aniline dyes and any desired shade obtained. To overcome any uncombined tannin upon the grain caused by the sumac, a solu-

tion of tartar emetic or of antimonine may be added to the sumac bath, and the result will be full even colors free from spots and streaks. About two ounces of either of the two articles are required by each dozen skins and the drumming continued for fifteen minutes after the solution is added to the drum. The leather may also be first milled in a solution of lactic acid made up of one gallon lactic acid to fifty gallons of warm water. This liquor seems to open up the grain and to remove all greasy matter.

A great deal of the success attained in coloring the tanned leather is determined by and depends upon the methods and materials used in the early preparatory processes of beam-house and tannery. Many of the dyers' troubles, such as unevenness of shade, streaks and imperfect penetration of the color solution are caused by careless or improper methods followed in preparing the leather for the process of coloring. In order to get light shades of color it is essential that the leather be light colored. When it is dark from the tannage it requires a bleaching and cleaning. Sometimes the appearance of the grain may be improved by a priming in picric acid. Sumac, as it contains very little coloring matter, is commonly used as a mordant upon chrome leather, and for the purpose of freshening up vegetable tanned leather before it is colored. Many of the tannages contain quantities of coloring matter and these exert an influence upon the shade. For some dark shades advantage may be taken of the coloring matter in the tannage and less dye used.

When the grain of the leather is greasy as well as cloudy it may be prepared for the process of coloring by drumming the leather in a solution of lactic acid and bichromate of potash. About one gallon of the acid and two pounds of the chrome should be used for fifty gallons of water, and the leather milled or drummed in this solution for thirty minutes, after it has been moistened and softened with warm water. This liquor may also be applied to give a

fuller and more even appearance to the colors by being used as a striker to fix or fasten the dye upon the leather.

Seasonings.

Used as a seasoning upon both chrome and vegetable tanned leather, the following liquor produces good results: One-half ounce bichromate of potash, two pints acetic acid, two gallons of egg-albumen solution, and ten gallons of water. In order to clear the grain of grease one gallon of apple vinegar, and a little bichromate of potash, mixed with ten gallons of water, may be used.

For black kangaroo leather this seasoning may be used: Five gallons of strong logwood liquor are blacked with five ounces of copperas; then are added one and one-half pints of blood, five ounces of glycerine, and eight ounces of ammonia. To remove surface grease and to deepen the black of the finish, a solution of vinegar and bichromate of potash is very useful, applied after the leather has received the first glazing. Special care is necessary to rub the glazing liquor, and indeed all liquors used in finishing, down into the grain. When this is not done the finish shows a grey bottom.

CHAPTER XX.

METHODS OF BLEACHING LEATHER.

IN many instances in the coloring of vegetable tanned leather, goat, sheep, calfskins, etc., it is considered advantageous to bleach the skins. This is especially desirable when the color of the skins resulting from the tannage is dark. A method of bleaching in frequent use is by sugar of lead and sulphuric acid. Correctly speaking, this is not bleaching but really coloring, since the light color acquired by the leather is the result of lead sulphate being deposited on the grain of the skins. None of the coloring matter is removed. It is generally a good plan to retan the skins in sumac before bleaching. Sumac tanned skins, of course, requiring no retanning. To properly prepare the skins for the process they should be taken in the dry or crust state and uniformly moistened with soft warm water. Then they should be milled in a pin-mill drum in warm borax water, so as to remove all particles of dirt, dust and tannin. A light retanning may then be given them. This is done preferably in a drum. The quantity of sumac to be used must be determined by the size and thickness of the skins, and ranges from one to two pounds for each dozen. The sumac bath should be warm, at a temperature of 100 degrees F., and the skins should be drummed therein for from one to two hours, after which they should be washed off in warm water, and are then ready for bleaching.

The bleaching may be done either in drums or vats, by running the skins in a sugar of lead solution of about two and one-half per cent. for thirty minutes, and then transferring them to a bath of sulphuric acid of about three per

cent., and leaving them therein until they have become white. The operations may be repeated as often as is considered necessary to get the skins sufficiently bleached. It is very important that all traces of the sulphuric acid are gotten rid of by very thorough washing in several changes of water. This method of bleaching has many unpleasant and objectionable features. Its cheapness and effectiveness are its chief recommendations.

Another method of bleaching

Is carried out by the use of permanganate of potash and bisulphite of soda and muriatic acid. The permanganate of potash liquor should be about a one per cent. solution, used warm, and the skins immersed therein for thirty minutes, when they are removed and thoroughly washed in clear water. After washing they are placed in a bath of bisulphite of soda and hydrochloric acid in the following proportions: Seven parts of bisulphite of soda and three parts of acid in fifty parts of water. In this bath the skins are left until they come to the desired shade. Peroxide of hydrogen is also used for bleaching.

*In a liquor made up of tanning material and an alkali,
followed by a treatment with sulphuric acid,*

The color of dark tanned leather may be considerably lightened. The first bath consists preferably of quebracho extract and an alkali, such as borax. The temperature of this liquor should be maintained at about 120 degrees during the operation, and the leather requires an immersion of five or ten minutes according to its character and the effect desired.

Upon being taken from this liquor the leather should be washed off in cold water. After this it is given an acid bath. Sulphuric acid may be used, also muriatic or oxalic acid. The temperature of this bath should be maintained at about 120 degrees, and the leather left in the same long

enough to acquire the color desired. After the acid treatment, the leather is removed, drained and washed.

When leather has acquired a dark color

From the tannage, and is to be colored, it is advantageous to remove from the stock, part of the original tanning material, and to replace it with sumac. To accomplish this the leather is taken in the dry condition and uniformly moistened with warm soft water, by being dipped into a tub of the same, and then placed in piles for a number of hours or until it becomes soft and moistened through.

It is then thoroughly washed in a drum in warm soft water, that is, water softened with borax, for thirty minutes, when the water is run off and a fresh supply run in, and the washing and milling continued for another half hour.

The leather is then treated with a weak liquor made up of water and sulphuric acid, in very dilute solution, for twenty minutes, after which it requires a very thorough washing in two or three changes of water. The leather is next treated with sumac, also in a drum, one to two pounds of sumac being used for each dozen skins. The temperature of the sumac bath should be about 100 degrees Fah., and the leather should be drummed in the same for from one to two hours, then rinsed off, set out and is ready to be colored; or it may be dried out and left in dry condition for some time until it is desired to color and finish it. For medium light shades the above method is satisfactory, but for very light and fancy shades the sugar of lead and sulphuric acid method may be used.

A process of bleaching leather,

Patented by Messrs. W. H. Krug and E. J. Haley, is carried out according to the following description: A bleaching liquor is first prepared by forming an aqueous solution of tanning material in any well-known manner, the strength

of the solution depending upon the character of the leather and the tannery practice. In this process the bleaching solution is preferably of the same, or of greater density than that to which the leather was last subjected in the preceding tanning process.

To the solution of tanning material there is added a quantity of alkali, a combination of alkaline ingredients not only sufficient to clarify the same, or dissolve the insoluble constituents naturally present in the tanning material, but in such excess as to secure the bleaching effect of the dye—that is, the color which is desired to be imparted to the leather, and according to the nature of the tanning material used. For securing leather of light colors the proportion of alkali is greater than when dark colored leathers are desired, and if the bleaching liquor is formed of the solution obtained of a bark, the proportion of alkali will be less than if it is formed from other materials, as quebracho extract, etc. The mixture thus obtained is then heated, preferably to a temperature of 100° to 140° Fahr., and is maintained during treatment at as nearly as possible a uniform temperature, and also at a uniform strength or density, by the addition at intervals of such quantities of tanning material and alkali as are required for this purpose. The leather is immersed in the bleaching liquor and is maintained therein for a short period of time, say from one to ten minutes or more, according to the character of the leather and the effect desired, the immersing being continued for a greater length of time to secure a denser product. In using the term alkali there is meant an alkali, alkaline salt, or alkaline combination of ingredients, as for instance, sodium carbonate or borax, or a combination thereof.

After the treatment in the alkaline bleaching bath the leather is transferred to an acid bath. This acid bath consists of a weak aqueous solution of any suitable material or organic acid, as sulphuric, hydrochloric or oxalic acid, or a

combination thereof, the solution varying in strength according to the character of the leather and the density of the bleaching alkaline liquor previously used, but being maintained as nearly as possible at a uniform strength during the treatment of the mass of leather to secure uniform results. The acid bath as before stated is preferably maintained at as nearly a uniform temperature as possible from 100° to 140° Fah., and the leather is immersed therein and permitted to remain a sufficient length of time to obtain the color and properties desired, the longer immersion securing a lighter color and heavier or denser leather. After the acid treatment the leather is removed, drained and washed with water to remove the acid. If it is desired to modify the color of the leather after the acid treatment, the leather may be immersed in a solution of tanning material, either with or without the addition of alkali, and be allowed to remain therein until the desired color and effect are obtained. This may be done before the leather is washed with water.

In bleaching hemlock tanned sole leather, this process may be carried out as follows: Assuming that the tanning liquor in the last layer from which the leather is taken has a density of 40° barkometer, an alkali bleaching bath is prepared of a density of 45° barkometer, by dissolving ninety-two pounds of quebracho extract, fourteen pounds of borax, and twenty-eight pounds of sodium carbonate in every ten cubic feet of water (625 pounds). This bath is heated to 140 degrees Fahr., and the leather taken directly from the last layer in which the tanning operation has been completed and is immersed therein for five minutes, whereupon it is removed, drained for a few minutes and then immersed in the acid bath. Five pounds of sulfuric acid are dissolved in ten cubic feet of water and the solution is heated to 140 degrees Fahr. In this acid bath the leather remains for five minutes, whereupon it is removed and thoroughly rinsed in cold water. When operating upon a

large number of sides, it is necessary to strengthen both the alkaline bleaching bath and the acid bath from time to time. In practice the density of the alkaline bath may fall to 40° barkometer, whereupon a sufficient quantity of very concentrated aqueous alkaline solution of quebracho extract must be added containing the same ingredients as the alkaline bleaching bath, and in the same proportions until the density of the alkaline bleaching bath again becomes 45° barkometer. The acidity of the acid bath is maintained by adding after every fifty sides which have been immersed therein from three-tenths to five-tenths of a pound of sulphuric acid to every ten cubic feet of water. If it is now desired to impart to this bleached leather an oak color, the leather is immersed in a liquor made from oak bark having a density of 40° barkometer, and a temperature of 100° Fahr., and allowed to remain therein until the desired color is obtained.

The above described treatment results in very material advantages over the ordinary process of bleaching. First, the leather instead of being reduced in weight, is maintained or increased in weight, and consequently is of greater density resulting in greater durability of the articles made therefrom. Secondly, the bleach instead of being a surface bleach, is one which may be prolonged so as to affect the entire fibre of the leather so that articles made therefrom will not vary in color from effects of wear. Thirdly, it is practicable, by varying the strength of the solution, to produce any desired shade and, therefore, to operate upon a mass of leather with uniform results in this respect. It is always preferable to make use of an alkaline bleaching bath in which the proportion of tanning material is greater than that from which the leather was taken in the preceding tanning operation, but it is possible to carry out this process with a bleaching solution in which the tanning material is in less proportion.

The use of a bleaching solution consisting of tanning

material, however, in connection with a sufficient quantity of alkali to produce the bleaching effect, instead of reducing the weight and density of the leather, as usual, will maintain or increase it, and in proportion as greater weight is needed it is desirable to increase the proportion of tanning material and alkali in the solution.

The particular ingredients used, the proportions of the same in the baths, and the density and temperatures of the bath may be varied, and depend upon the tannery practice.

More is said on the subject of bleaching and clearing leather in the last chapter of this book.

CHAPTER XXI.

PREPARING HEAVY HIDES FOR TANNING.

THE tanners of hides receive their raw stock in one of three conditions, viz., green-salted, dry and dry-salted. All hides that are made into leather come to the tannery in one of these conditions. Native or domestic hides are generally green-salted. Imported hides are green-salted, dry and dry-salted. It does not matter in what condition hides are received, nor the kind of leather into which they are to be made, they require soaking in water, as a preliminary and preparatory process, before any attempt is made at removing the hair or tanning the hides.

The ends and objects to be accomplished during the soaking process are thorough softening of the hides and the removal from them of all foreign substances such as salt, dirt and blood. The hides should always be thoroughly softened without being allowed to become flaccid. The importance of the soaking process is not always recognized; and yet, because it comes at the very beginning of the leather-making operations, it is a matter of considerable consequence that the hides are thoroughly cleansed and softened in order that they may be worked the more satisfactorily through the subsequent processes.

Salted hides when they are soaked too long lose some of their gelatine, and this results in loose and spongy leather. On the other hand, if the stock is not soaked long enough to accomplish the objects of the process, the grain of the finished leather shows up undesirable shades and streaks. In the soaking of salted hides it is a good method to follow to soak the hides for a number of hours in clean water, and then to either draw the hides out of the water

and running it off replacing it with new, or to hang the hides over sticks and suspend them in the water so that the water can be easily changed. The water should be changed two or three times during the process, depending upon the condition of the hides. In some instances it is not necessary to change the water more than once.

The changing of the water not only hastens the softening, but also rids the hides of salt and dirt in a short time. Another object of changing the water is to prevent the accumulation of salt and dirt in the soaks, which do not act as preservatives, but on the contrary frequently cause a loss of substance by reason of the gelatine that is dissolved out of the hides. Hides soaked in hard water absorb large quantities of water, and consequently become soft in a short time. It is claimed, however, that hard water containing the salts of lime and magnesia, tends to affect the substance of the hides. It is well known that different results are obtained in various tanneries by the use of different kinds of water; and also that the finest-textured leather is made when only clean soft water is used. Hard water is generally softened by the addition of borax. About five pounds of borax soften one thousand gallons of water. It should be dissolved in hot water and poured into the soak water before the hides are put in. Sulphide of sodium may also be used with good results, as may also boric acid, which being an antiseptic prevents decomposition and loss of hide substance.

Ordinary hides are sufficiently soaked in from twenty-four to forty-eight hours. No exact rule can be given or followed, as much depends upon the condition and thickness of the hides and the temperature of the water. It is important that all blood, salt and dirt be gotten rid of in the soaks. These substances, especially the blood, dirt and refuse from the stock soon putrefy, the putrefaction readily injuring the hides. For this reason, and also because of their unpleasant odor, it is not the best practice for a tanner

to use soaks over and over for different lots of hides. Old stale soaks certainly soften hides in a short time, but very often at the expense of some desirable quality of the leather. Sometimes the defects that are the result of improper soaking, are not noticed until after the hides are tanned, and then no one can tell what caused them and the blame is laid in some other portion of the work.

Pricked and pitted grain are some of the effects of careless soaking. The former is in appearance similar to what would be caused by puncturing the grain of the hides with pins. This is sometimes caused by soaking for too long a time, especially in hot weather. Pitted grain is similar to the foregoing, only the holes are larger. The hides begin to decompose before they are taken from the water, and no subsequent treatment can remedy the defect.

Soaking green-salted hides.

A common method of soaking green-salted hides, among tanners of upper, sole and harness leather, is to put a pack of hides into the soak on one day; and on the next day to pull it out, and allow the dirty water to run off. Then the hides are put back into another clean, fresh soak for another day. Some tanners also mill their hides in a drum for a few minutes, but this is not always necessary. At the end of the soaking process the hides are removed from the water, drained, fleshed, split from head to tail, pinned together with hooks into a long chain and are then passed into the limes.

When the soaked hides have been removed from the soaks, and before they are limed and unhaired, they are frequently piled in heaps. Heating occasionally sets in, especially in warm weather, and in a short time the stock is seriously damaged. When heating once sets in the hides rapidly decompose and the total loss of the stock can only be prevented by airing them at once or by immersing them in cold water. Heating always injures the stock, more or

less, according to the degree of heat developed, and it is therefore very important to guard against loss in this way as much as possible. The hide piles should be handled frequently, or, better still, no delay should take place but the hides passed at once into the next process. Hides that have been preserved with salt and partly dried, require more thorough soaking than green-salted ones. The drying of moist salty hides effects a change in the fibres, and the hides consequently need a soaking for two, three or four days, and a drumming in a drum, or working in a hide mill, in order to get them properly freshened up.

Owing to the difficulties met with in soaking dry or flint hides, and bringing them back to the natural soft and pliable condition necessary before they can be worked through the processes of the beamhouse and tanning, many tanners neglect this class of stock ; and yet when the soaking and softening are properly done, very good leather is made from dried hides. Certain it is that no class of hides with which tanners have to deal requires more thorough treatment in the beamhouse than those that are received in flint-dry condition. In many instances the work is not fully understood, and the results are that the hides are not treated right and are subjected to much abuse and condemnation. Having been dried in the raw state, they are almost waterproof, and as they are very thick and heavy they are softened with considerable difficulty. Frequently too, before the hides become thoroughly dry, decay and putrefaction set in, which although not noticed at the time, will become readily apparent during the soaking process. Then every spot that was not perfectly cured or that was tainted with decay before drying will appear either by the hair coming off, the grain peeling or by portions of the hide rotting away. The uneven thickness of the hides also causes very uneven softening, and even when they are received by the tanner in good condition the thinner portions are liable to decay before the thicker portions have become thoroughly

softened. It is very necessary that all portions of the hides be thoroughly soft before the process of depilating is begun. When not thoroughly soft the limes cannot do their work and trouble is encountered at any stage of the subsequent manipulation. The placing of the hides in clear water with nothing to assist in the softening is liable to result in injury to the hides, since before the thick portions become sufficiently soft the thin ones along the sides and in the flanks suffer more or less injury. The long soaking also results in the loss of much of the hide gelatine, and this always results in loose and spongy leather. The grain is very apt to be injured by what is known as pitted grain, and much time is unprofitably consumed. In order, therefore, to hasten the soaking, and at the same time to bring the hides through in good shape, it is necessary that some solution of chemicals be added to the soaking water that will accomplish the desired results. Borax and sulphide of sodium are safe and very efficient for the purpose. When borax is used, from two to five pounds are taken for each one thousand gallons of water. It should be dissolved in a separate vessel and poured into the water in the vats under vigorous stirring. Sulphide of sodium is, however, without doubt, the best softener that can be used, being not only very rapid in its action but comparatively cheap. From two to five pounds are enough for each one thousand gallons of water. Caustic soda when used in moderate quantity produces good results, although it has a tendency to dissolve hide substance if used in too large quantity. Boracic acid may also be used in the soaks, and being an antiseptic prevents, to some extent, decomposition and loss of substance.

Danger of putrefaction.

The most serious danger in connection with the soaking of dry hides is the liability to putrefaction. This may be guarded against by the use of the articles mentioned above and by keeping the soak vats clean by frequent changes of

water. Old stale soaks in which pack after pack of hides are softened and in which blood, salt and dirt accumulate and soon putrefy, certainly soften the hides in a reasonably short time, but often at the expense of some desirable quality of the leather. The bacteria of putrefaction that are generated in foul soaks rapidly dissolve the hide substance, and thus affect the texture and weight of the leather.

A good method to follow is to soak the hides for two days, or until they become partially softened; then to split them from head to tail, put them into an ordinary revolving drum or pin-mill and drum them for some time. This helps in the softening. The sides may then be put back into the soaks for another day or two, and reworked if they require it. A hide mill or fulling stocks are also used. The hides should not be subjected to the milling or fulling process until they are sufficiently soft to bend them without injury. The softer and cleaner the hides are before they are unhaired the better will be the final results.

A good method of soaking dry hides is to put them in a strong brine or solution of salt and water. In a soak prepared of salt and water the hides may remain three or four days, they may then be worked in a hide-mill or drum and then resoaked in the salt water for four or five days longer or until they have become soft. Before hides treated in this way are limed the salt should be gotten rid of either by soaking or washing the hides in clear cold water.

An old practice and one that is sometimes employed even at the present time, consists in soaking dry hides in old tan liquors. Under ordinary conditions such liquors soften the hides in a short time, from twelve to twenty-four hours; but their use is very unpleasant and somewhat unhealthy. The fibres of the hides are contracted and this results in shrinkage. After dry hides are soaked and softened, they are further prepared for tanning, and are tanned in much the same manner as salted hides are treated. The methods of handling hides vary of course with different manufacturers according to the class of leather being made.

The methods of preparing dry hides for tanning, after they have been soaked and softened, are not radically different from those employed upon salted hides. They vary according to the class of leather being made. The office of any material used for the purpose of preparing hides for soft, supple leather, is to swell and distend the fibres, thus loosening the hair roots so that the hair can be readily removed ; then to dissolve the perishable animal matter of the hides so that it can be removed before tanning. When these things have been done, soft pliable leather can be made and not before. To accomplish these objects lime has been used for a great many years. Its use, when it is employed alone, has some unpleasant features. On hides intended for soft leather, the action of lime is to dissolve the animal matter faster than it distends the fibres, and the result is loose, spongy leather with a loss of weight and substance. If the hides are not limed long enough to dissolve all of the animal matter in them, the resulting leather finishes up hard and firm. To overcome the objectionable features of lime, sulphide of sodium and red arsenic are used. These materials when properly used, loosen and split up the fibres, thus loosening the hair in a shorter time than when lime is used alone. They do not dissolve as much of the hide substance as lime does ; and when either of the two articles is used in conjunction with lime a very satisfactory process is obtained, the results of which are the unhairing of the hides and the preparing of them for tanning in a comparatively short time and in a very satisfactory manner.

For the process of preparing hides for soft and pliable leather no exact rule can be given or followed. A great deal depends upon the tannage that is used, and the degree of flexibility desired in the leather. It is generally considered by good tanners, that to start the sides in old weak lime liquors and leave them therein for two or three days, or until they are thoroughly impregnated with the liquor, and then to increase the strength of the lime by the addi-

tion of new lime, or to pass the sides along into stronger limes, is better than to use strong limes at the start, especially when leather, of which softness and smoothness of grain are essential qualities, is wanted. The use of sulphide of sodium or red arsenic, mixed with the lime, keeps the grain from becoming rough, shortens the time of liming, and helps to make soft leather of fine texture. Both materials are very energetic and rapid of action. Some tanners prefer red arsenic to sulphide of sodium, while others get the best results when sulphide of sodium is used. Red arsenic gives the leather considerable elasticity and smoothness of grain, more so than the sulphide of sodium. The main thing for a tanner to guard against is liming the sides too long. From five to seven days is generally sufficient, although much depends upon the season of the year, and the temperature and strength of the liquor. The best results are obtained when limes are used over and over for succeeding lots of sides, provided these limes are kept clean and not allowed to become foul. New limes used during the entire process do not give to the leather the right feeling of softness and pliability. They also produce harshness of grain and fibre. The sides are tied together with hooks upon coming from the soaks and after having been trimmed and fleshed; and before going into the limes they should be well drained in order to get rid of salty and dirty water. They may be left for a day or two in an old mat lime.

A good lime can be prepared by using two-thirds old liquor and one-third new, that is, of six feet of liming liquor in the vat, four feet may be old and weak liquor and two feet new and fresh, or of six hundred gallons in the vat four hundred gallons may be old and two hundred new. In preparing new lime one hundred pounds of lime may be slacked in twelve pails of hot water. For this amount five pounds of arsenic may be used. It may be dissolved separately in hot water and then added to the slacked lime. Both materials should be thoroughly dissolved before com-

ing into contact with the stock. The quantities of arsenic and lime mentioned are enough for two hundred and fifty sides to begin with. After the sides have been in the liquor for one day, they may be drawn out and the lime well stirred up from the bottom of the vat. If the sides are allowed to drain before they are put back, they will take up the lime again more readily. When vats with paddles are used the pulling out is not necessary, although it is a good plan to keep the lime well stirred up from the bottom of the vat. On the third day it is well to strengthen the lime by the addition of fresh lime, or the sides may be passed along into a stronger lime. The strength to begin with should be about three degrees Twaddle, and by the addition of lime and arsenic the strength should be about six degrees towards the end of the process. These are safe strengths to work by, but are not fixed.

When too much fresh lime is used toward the end of the process, the grain is liable to be roughened. This may be overcome by washing in a manure bate, followed by a bath of lactic acid. After the hair is loosened it is wise to leave the sides in the lime for a day or two longer, as this not only allows the hair to come off readily and cleanly but also makes the leather softer.

A good method to follow is to keep the sides in old weak limes for four or five days, being handled each day and passed into stronger limes. On the fifth day the sides may be put into fresh lime. This may be made up of one hundred and fifty pounds of lime and eight pounds of arsenic for three thousand pounds of raw stock. To strengthen this lime when the sides are hauled out the next day, seventy pounds of lime and four pounds of arsenic may be used. On the seventh day the sides may be unhaired, and then left in strong lime for twenty-four hours, when the process will be completed. No dirt should be allowed to accumulate in the limes, as the cleaner the limes are the brighter and cleaner is the grain of the finished leather.

When sulphide of sodium is used with lime it is employed in much the same manner that red arsenic is used. The first lime in which the sides are placed may be old and weak, and the sides may remain in this lime one day. Then the lime is strengthened up with sulphide of sodium; for three thousand pounds of raw stock two hundred pounds of lime and twenty pounds of sulphide of sodium for fresh lime. On the third or fourth day, for strengthening up the lime seventy-five pounds of lime and ten pounds of sulphide of sodium may be used. From five to seven days liming is sufficient, the sides being then unhaired.

Satisfactory results are also obtained by the use of about one hundred and fifty pounds of lime and fifteen pounds of sulphide of sodium for each one thousand pounds of stock. The sides should be handled each day and upon the third day the liquor should be strengthened by the addition of one-third the quantities of lime and red arsenic first put in. A little more lime may be added upon the fourth day, and in six days the stock should be ready for unhairing.

The best method of liming the hides must be learned by a tanner from experience, and depends largely upon the tannage used and the class of leather being made. As a consequence it is impossible to give any hard and fixed rule for determining the strength and length of time consumed in the liming process. The old limes can be used over and over by being strengthened up with lime and chemicals. Some tanners start their stock in new and strong limes and finish up in weak ones. They say that this method makes the leather very plump as well as soft. To start the hides in an old lime and gradually increase the strength of the liming liquors is, however, the preferred method, as there is not the sudden and violent swelling of the fibres, which often results in making the grain loose from the flesh. Extreme plumping at the start has a tendency to weaken the fibres.

For the making of soft, pliable leather, of which some

elasticity and smoothness of grain are essential qualities, it is necessary to get rid of all the lime and alkaline sulphides acquired by the stock during the process of liming. This result is accomplished by the process commonly called bating. The prime object of this process is to remove the lime, thereby getting the stock in neutral condition to accept the tannage. No lime whatever can be allowed in the stock, lime being the great obstacle in the way of getting soft and even-colored leather.

Tanners, as a rule, recognize the importance of the bating process, as they are well aware that much of the quality and texture of their leather depends upon how this process is carried out.

Dog, pigeon and hen manures have been used for a great many years. Their use is unpleasant in the extreme and attended by many dangers. To take the place of manures several articles have been introduced, some of which have met with success in practical use. The use of chemical bates is on the increase, owing to their cleanliness, safety and cheapness. In another part of this book descriptions of several practical bating processes are given.

Bird dung is very rapid in its action, and makes the leather silky and tough, but without much spring. On the other hand dog dung has a great softening effect, and produces leather with considerable elasticity. The best results are obtained by mixing the two kinds. Chicken manure is also in general use. A detailed description of manure bating is given in the chapter on goatskins. The process is applied to sides in much the same manner as upon goatskins; and the best results are secured when, after bating, the sides are washed in a weak lactic acid bath. To accomplish rapid tanning the sides must be perfectly free from lime before they go into the tanning liquors.

Lactic acid is one of the safest and cleanest articles that a tanner can use as a bate. For sides intended for either shoe or glove leather it may be used with very good results.

After the sides are taken from the limes, they are washed, preferably in warm water, in order to remove from them as much lime as possible. A paddle vat or reel is filled with the requisite quantity of water heated to about 95 degrees Fah. To each one hundred gallons of warm water about one gallon of lactic acid may be used. The amount of acid required, however, depends upon the amount of lime present, and may be varied to suit the requirements. A warm bate serves to neutralize the lime and also to bring down the stock, making it thin and soft, while a cool bate, though it neutralizes the lime satisfactorily, leaves the stock plump. After being paddled about in the liquor for from one to two hours, the sides will be found to be sufficiently drenched to be removed and given the usual working upon the grain. Stock bated in this way will bear a much harder working upon the grain than stock bated with manures. After the working, the sides may be put back into another drench prepared with one-half the quantity of acid used in the first instance. At the end of one hour they may be removed and washed off, and will then be in condition for tanning. The lactic acid baths can be freshened up for succeeding lots of skins by the addition of one-half the quantity of acid used in the first instance. When the hides have been split after liming, less bating is required than when they are not split until after being tanned.

Lactic acid dissolves the lime in the stock without affecting the tissues or fibres of the hides.

Leather made by a vegetable process frequently shows dark and brittle spots upon the grain. These are the result of lime left in the stock. Hard, brittle leather, with little or no give or elasticity also results when lime is left in the stock.

CHAPTER XXII.

SIDE LEATHERS FOR SHOE PURPOSES AND METHODS OF TANNING THEM.

IN the making of side leathers that are finished upon the grain and intended for shoe leather various processes of tanning are employed. Straight hemlock liquors are used and combinations of hemlock extract with other extracts, such as quebracho and gambier; palmetto extract is used alone, also in combination with other tannages; gambier is used in the same manner as palmetto; the dongola process is sometimes employed, also combination processes of chrome and vegetable tannages. The tanning is done in vats provided with paddles by which the tanning liquor is stirred, and also in pits in which the sides are suspended, and not subjected to much agitation. The less agitation the sides are subjected to the fuller and plumper is the leather, especially in the flanks and along the sides.

Some tanners start the tanning in hemlock liquors, and after the stock is well struck and split, they finish in gambier or other liquors.

Gambier has long been a staple tanning material. The leather it makes is soft and tough and readily adapted for coloring and finishing in any desired manner. Very good leather is made by combining gambier with a chrome or mineral process.

The tanning with gambier, when it is used alone, is a very simple straightforward process. The sides are entered into a weak liquor at the start, which is gradually strengthened by the addition of fresh gambier until it becomes fairly strong towards the end of the process. Common salt serves a useful purpose in gambier tanning. It assists

greatly in making soft leather and also hastens the tanning process and prevents contraction of the leather fibres. Paddle-vats are very convenient to use. It is well for the tanner to divide the vats into three sections. In the first section the sides are handled and colored; in the second section the tanning is carried forward until the stock is ready for splitting; and in the third and last section the retanning or tanning after splitting is done. At the beginning the liquor may be four to five degrees barkometer. After the sides have been put into the liquor they should be stirred about by the paddles for one hour to assure a good color upon the grain. The liquor should be strengthened twice each day, the quantity of fresh gambier liquor required depending upon the size of the vats and the strength of the liquors to begin with. No exact quantities can be stated, as each tanner must decide this and many other points by his judgment. The turning over of the sides in the liquor hastens the tanning and by changing their position assures a uniform color. The liquors used at the beginning of the process for coloring and striking should be run out at least as often as once a week as they soon become almost worthless. When still tanning is done, the sides are nailed on sticks and left hanging in the liquors. They are tanned, split and retanned. Palmetto extract is a very good retanning material for both splits and grains. It puts the leather into condition to stand heat well and to take and carry the grease well, and it also gives to it waterproof qualities and toughens it. After the leather is tanned through it may be strengthened and cleared by being run in a drum with a solution of alum and salt.

In about thirty gallons of water are dissolved fifteen pounds of alum and ten pounds of salt, this quantity of liquor being enough for one hundred and twenty sides of medium size. In this solution the sides are drummed for thirty minutes, and should then be allowed to drain off well. It is well to remove the surplus tanning liquor by washing

the leather in a drum in lukewarm water for about twenty minutes. This is an advantage for colored leather but not necessary on black leather. Then the leather is ready for pressing, and may be fat-liquored and dried out; or it may be dried out first and then moistened back and fat-liquored.

Palmetto extract

Is a very useful tanning material to use either in place of gambier, or in combination with the same. It may also be used with good results in conjunction with hemlock and other tannages. The sides may be tanned in liquors made up of palmetto and other extracts in almost any proportion, or they may be well struck with hemlock or other liquors, and after being split they may be retanned in palmetto liquors. This material gives good weight and is a rapid tanner. It makes full, plump leather, tough and of good color, and able to stand a great deal of heat.

A good method of tanning the sides in palmetto liquor

Is to take the same after fleshing, bating and washing and paddle them about in a bath of muriatic acid for one hour. For fifteen hundred pounds of sides nine pounds of muriatic acid may be used, and after this the sides may be passed through a manure bath for one hour, at a temperature of 85° F., and then slicked out and drained. The tanning may be begun by nailing the sides on sticks and immersing them in an extract liquor beginning at 12° Barkometer, and ending at 20°, the time being about six days. Care should be taken to color every part alike. The sides are then taken off the sticks and passed into a 30° Baumé palmetto liquor. In this liquor they should be handled twice daily so that the tanning may be uniform. In about six days the sides are tanned through, and are then pressed and split. The retanning is done in a weak palmetto liquor 12° Baumé, which is increased to 30°. In six hours they are thoroughly tanned. The grain is made tough and

strong and not loose or liable to "pipe." Light sides, or sides that have been split before tanning, and kips may be readily tanned in drums. They are started in a weak, cold palmetto liquor for one hour, the strength of which may be about 10° Barkometer. They are then tanned in a drum with a liquor of 30° Baumé, 51 Twaddell, at a temperature of 75° F. For seven hundred pounds of hides four hundred and fifty pounds of extract are used. The wheel should rotate the same number of times one way as the other. In from six to eight hours the stock will be tanned. It may then be pressed, split and retanned for one hour in a liquor of 8° or 10° Barkometer. It may also be retanned in a drum for one hour with strength of liquor 30° Baumé, 51 Twaddell, after which it is washed in lukewarm water. The water used for this washing may be used for coloring a fresh pack of stock as it comes from the beam-house. The leather after washing is pressed and fat-liquored.

The tanning of side leather may be commenced in hemlock liquors, and after splitting the sides may be retanned in gambier or palmetto liquors. This method is very satisfactory. Tanning extracts are used in a great number of combinations. Quebracho and gambier are combined with good results, also hemlock and quebracho. The latter named tannage produces the best results when it is used in combination with some other tannage. At one time quebracho extract was almost all made in liquid form, but the solid extract is now preferred, owing to economy in freights, etc.

Quebracho, its qualities and its use

Quebracho is not a good plumper, and for this reason some material is necessary to plump the leather. Lactic acid used in the handling process increases the plumpness of the stock. A small per cent. of divi-divi used in connection with quebracho tends to improve the color.

The Quebracho tree grows in the central part of the Argentine Republic, and is one of the hardest woods known. It is most difficult to cut, and derives its name "(Quebrar"—to break—"ache"—an axe) from the fact that the best axes go to pieces in cutting down the trees. The trees are of extremely slow growth, and logs such as are shipped to the United States and Europe for purposes of making extract are often a thousand years old. The heaviest machinery is required for cutting this wood up into a form suitable for extraction, and, owing to its great weight, the handling of Quebracho logs, which often weigh two or three tons each, is both difficult and dangerous. The bark of the Quebracho tree is useless for tanning purposes, and together with the sap-wood is removed before the logs are ready for shipment.

The extract made from the wood of the Quebracho tree is different from all other known tanning extracts, chiefly in the fact, that it will not turn sour. In addition to this, it is a comparatively clean extract, that is to say, it contains a higher percentage of tan to a given density than any other of the well known extracts. Inasmuch as it has little or no tendency to fermentation, Quebracho is extremely useful for controlling the acid in tan yards that tend to go sour. On the other hand, if it is used in yards, where considerable acid is needed, care must be taken to prevent the sweetening up of the liquors by the use of too much of this extract. This is obviated by the use of artificial acid, or, as in Europe, by the employment of other tannins, which contain a large proportion of other materials.

Quebracho, being a sweet tan, is not of itself a plumper, and if it is used on leather which has not been properly plumped, is apt to quickly tan the outside of the hides, and thereby prevent the penetration of the tan to the inside. This results in cracky leather not properly filled. If, however, hides are plumped before going into Quebracho liquor, this material will penetrate, fill, and produce tough pliable stock of light color.

A very important point to be observed in using Quebracho extract is, that it should be dissolved properly. Solid extract needs to be boiled up in hot water, in a tub containing a false screen bottom which prevents the extract adhering to a solid surface. The liquid extract should be dissolved in water standing at 180 degrees. The resulting solutions from both grades of extract, should then be stirred well and allowed to cool down gradually before being used. It is a great mistake to run off hot Quebracho liquor into cold vat liquors, or in fact to suddenly chill any extract liquor. Such sediment as remains in the cooling tub may be worked up with fresh water on a tail leach or elsewhere.

A great deal depends upon the proper dissolving of Quebracho in its successful use in the vats, and it is far better that such precipitation as takes place should go on in the cooling tub rather than on the leather.

The use of the Barkometer. The barkometer underrates the strength of tannin in Quebracho when compared to the strength of ordinary bark liquors. This is owing to the fact that the Quebracho wood contains very much less material which forces up a barkometer than does bark. A pure Quebracho liquor, for instance, made up from nothing but Quebracho extract and water at 20° Barkometer is fully as strong in tan as a sweet bark liquor of about 30° Barkometer. This variation in the barkometer value must be taken into consideration, or else the tanner is apt to get the Quebracho liquor too strong and burn the fibre of the leather.

Quebracho, being sweet, tends to make pliable leather rather than hard leather, the latter resulting more or less from sour liquors. On heavy leathers, such as harness and belting, it is extremely useful on account of the toughness which it gives to the leather. On sole leather, when it is used with bark, it gives a somewhat mellower feel than the straight bark tannage.

It is being used with success on upper leathers for a fore-

tannage, and also for retanning splits coming therefrom. On patent leather it is particularly useful on account of the pliable qualities which it gives to stock that is to receive a coating of varnish.

Quebracho produces leather of an oak shade, with a very slight pinkish tendency. Leather tanned with this material, however, should not be dried in the sun, as the color becomes red on exposure to the light.

Hides that are intended for quebracho liquors should be very thoroughly cleansed from lime, that is to say, properly bated, since Quebracho and lime do not go at all well together. Bark liquors act more or less as a bate all the way through, but Quebracho, with its peculiar sweetness, does not do so and on coming into contact with lime in hide fibre produces bad grain and bad color.

Quebracho is useful in the tanning of heavy leathers in strengthening the head liquors, and in keeping them sweet. It penetrates very quickly and by its use tanners are often enabled to increase the weight of their leather. The best results are obtained by mixing Quebracho extract with other tanning materials, such as oak and hemlock in the tanning of heavy leathers. The process of tanning is quickened by the use of Quebracho, and the cost of tanning is somewhat cheapened. It is useful in making sole leather as well as upper and harness.

Retanning with gambier or palmetto

Leather that has been tanned in a chrome process may be retanned with gambier or palmetto. The latter extract has the good effects of neutralizing any trace of acid left in the leather, and also serves to put the leather in good condition to receive any shade of color or black. The grain is made smooth and remains so. For the retanning, for three thousand pounds of chrome leather, three gallons of palmetto extract and one pint of glycerine may be used. The extract is dissolved in the amount of warm water necessary,

the same being when ready for use about 90 degrees of temperature, and the leather drummed in the liquor for from one to two hours. When a one-bath process is used, the sides may be tanned first in chrome liquors in drums, or paddle-vats, and then retanned in gambier or palmetto. For the chrome process, the sides should be split before they are tanned, immediately after liming, and then bated, washed and tanned. The sides may also be given the palmetto liquor first, and afterwards the chrome process. One-bath liquors are handled in the same manner as bark or gambier liquors—that is, the sides are started in a weak liquor and this is gradually strengthened until it becomes strong, containing about five gallons of concentrated tanning liquor in one hundred gallons of water. The tanning with chrome liquors is also done in drums.

Salt is necessary in most chrome processes. It keeps the stock open and plump and receptive to the tanning liquor, and also hastens the tanning process and helps in making soft leather.

In paddle-vats or vats with rockers, a two per cent. liquor is used at the start, and this is gradually strengthened until it becomes a five or six per cent. solution, that is, to one hundred gallons of water in the vat about two gallons of tanning fluid are used at the beginning of the process and during the tanning enough concentrated tanning liquor is added to make the liquor from four to six per cent. Soft water should always be used, as hard water contains too much lime and magnesia.

The sides may be first tanned with alum and salt and then chrome tanned. The less pounding and drumming the sides are subjected to the finer and plumper the leather. The best method of tanning is by suspending the stock in the liquor, as by this method there is little or no pounding or agitation. The first cost of tanning sides by suspension is more than by other ways, as a large quantity of liquor must be made up, but after one lot of sides is

taken out another lot can be put in and the entire strength thus exhausted; the suspension method being thus the cheapest in the long run. Before chrome tanned sides are retanned in a vegetable process they should be thoroughly washed and pressed.

The dongola tannage

Consists of salt, alum and gambier. The sides, when split before being tanned, may be tanned in the dongola liquor, or when they are not split until after tanning they may be started in hemlock liquors or any other liquor or combinations of tannages, and when well struck with the tanning liquor they may be split and retanned in a dongola liquor.

A combination process of gambier and quebracho

Also makes good leather. The sides for this process may be started in bark tan liquors and left therein for four or five days, then washed well in cold water, pressed and split. After splitting the stock may be skived and then split again to the desired substance. The splits may go back into the bark liquor for the retannage.

In this way the splits are all bark tanned. The grain sides may be tanned, or rather retanned, in quebracho and gambier. Gambier may be used alone, or palmetto may be mixed with quebracho, and either palmetto or quebracho may also be used alone. Some tanners who tan the grains of the split sides in a chrome process first mill the sides in salt and alum before splitting them. When this is done, the grains go at once into chrome process while the splits are tanned out in a vegetable process. The best way to treat such splits full of alum and salt is to mill them in a drum in a weak gambier liquor until they are thoroughly softened. Then they may be retanned in extract or bark liquors until they are thoroughly tanned and filled. In this way no salt and alum will be left in the stock to spew out upon the surface after the leather is dried out. To wash the splits in water previous

to putting them in the bark or extract liquors makes them flat and lacking in plumpness. It would be impossible to plump them again, and nothing but flabby leather would result. By milling them up in a gambier liquor the plumpness and fullness are retained.

When the sides are split immediately after the liming process is completed, the splits should be bated and drenched, and then tanned in bark or extract liquors. In vats from eighteen to twenty days suffice. The grains taken from the sides in this way of splitting them may be bated and washed and tanned in chrome, gambier, palmetto or combination processes. This branch of leather making is a success, the demand for leather made in this way being on the increase. By splitting the hides in the green condition, recently made more practicable than ever by improvements in the belt knife splitting machine, there is given a yield of leather from one to one and one-half pounds greater per side than when the splitting is done after the sides have been partially tanned. Neither is there any strength lost by green splitting.

A good dongola liquor.

In some instances sides that have been tanned in hemlock or combination liquors are split and the grains are then retanned in dongola liquor. A good dongola liquor for this purpose may be made of the following proportions: In one hundred gallons of water are dissolved by boiling thirty pounds of salt and forty pounds of alum. These should be boiled until they are thoroughly dissolved. One hundred and eighty pounds of gambier are boiled in two hundred and fifty gallons of water until dissolved, and the gambier liquor is then added to the salt and alum solution in a vat or pit. By the addition of one hundred gallons more of water and one quart of sulphuric acid there are made five hundred gallons of dongola liquor.

When the retanning in the dongola liquor is completed

the leather is washed and pressed, and then given oil in a drum. Three gallons of neatsfoot oil may be used for this purpose for each three hundred pounds of leather. Fish oil may also be used. The leather is drummed in the oil for twenty minutes, and then hung up and dried out. The oil prevents the grain from cracking during drying. The sides are then stored away until they are to be finished. When a dongola process is used from the beginning, the sides are pickled after bating and washing in salt, sulphuric acid and water—five hundred gallons of the latter and two hundred pounds of salt, and thirty-five pounds of acid being used, and the sides stirred about therein for six hours. Then they are entered into a gambier, salt and alum liquor. The gambier liquor should be about six degrees barkometer, to which are added ten pounds of alum and seven pounds of salt for each one hundred gallons of liquor. When tanned, the sides are drained or pressed and then split. The second tanning liquor should be a straight gambier liquor. Leather is also made by applying first the alum and salt, and then the gambier liquor.

The strength of tanning liquors must be decided by the tanner for himself. It depends upon the season of the year and upon the results of the liquor upon the stock. The best guide to follow is constant observation of the effects of the liquors upon the leather.

The splits taken from the sides are tanned in almost as many ways as the grains. The process used depends upon what the tanned leather is to be used for, and may be hemlock, quebracho, gambier, dongola, bark or combination. Splits are used for a great number of purposes—innersoling, chair leather, mitten stock, wax shoe leather, binding leather and many other uses.

CHROME-TANNED SIDE LEATHER.

When the grains come from the splitting machine, they may be put back into lime for a day or two, depending

upon how much liming they received before splitting. For the bating process manure may be used, but it is best to combine it with lactic acid, that is to give the grains a drenching in lactic acid after they have been bated with manure. Lactic acid may also be used alone, also any other process of bating with which the tanner may be familiar. Pigeon manure seems to be better adapted to this class of stock than any other. It may be combined with hen manure in equal proportions with good results. After the grains have been bated in a manure bate they should be drenched in lactic acid. A bath should be prepared of warm water preferably in a paddle-vat, and for every hundred pounds of sides that have been bated with manure from one-fourth to one-half of a pound of lactic acid should be added to the warm water. In the prepared drench, the grains should be drenched for three-fourths of an hour, then washed off in warm water and are then ready for tanning. The grains can also be drenched in a drum, being run therein for fifteen minutes. To drench the stock with lactic acid after it has been bated with manure is the best possible manner of preparing it, as it makes it perfectly clean and free from lime.

The use of manure may be dispensed with and the grains bated and drenched with lactic acid in the following manner: After the grains come from the limes or the splitting machine and have been washed, a bath of warm water is prepared and for every hundred pounds of stock one pound of lactic acid should be added to the water. The sides are processed in this liquor for about two hours; they are then put through the slating machine or worked on the grain, after which they are again drenched with lactic acid in a bath made up of sufficient warm water and one-half of a pound of acid for every hundred pounds of stock. In this they are processed for one hour; and are then washed in clean water and are ready to tan.

A lactic acid bath can be used over and over by freshen-

ing it up each time with one-half the quantity of acid used in the first instance.

Tanning the grains.

To accomplish the tanning of the grains both one-bath and two-bath processes may be used. When the regular two-bath process is used, the sides need not be pickled previous to tanning. Two-bath processes have been fully described in other portions of this work, and it is not necessary to repeat the descriptions here. The proportions of ingredients used, and the manner of using them are the same as when other classes of skins are being tanned.

When the one-bath process is used there is always a tendency of the liquors to draw the grain and contract the fibres. Common salt serves to prevent this to some extent, and it should be used freely in one-bath tanning.

Good process of one-bath tanning.

A method of using the one-bath process that results in tanning the grains without drawing the grain is carried out in the following manner: The sides, after bating and drenching, are pickled in salt, sulphuric acid and water. For two hundred pounds of stock weighed after washing, two and one-half quarts of acid and fifty pounds of salt in sufficient water to cover the sides are used. The sides should be stirred about in the pickle for six hours, although they may be left in longer without injury, and upon being removed from the liquor they should be well drained before they are tanned. The drained pickled sides are then weighed. For each one hundred pounds of the same a solution is prepared of three pounds of sulphate of alumina boiled until dissolved in five gallons of water.

Another solution consisting of three pounds of sal-soda, dissolved by boiling in five gallons of water is prepared. The soda solution is poured slowly and with constant stirring into the alumina solution, and when both are combined they should be allowed to cool or enough cold water

should be run in to reduce the temperature of the solution to 85° before the liquor is used.

The drained pickled sides are put into a drum with ten pounds of salt and five gallons of water for each hundred pounds of pickled sides. In this salt and water the sides are drummed for fifteen minutes, then the solution of sulphate of alumina and sal-soda is poured into the drum and the sides drummed in the same for about one hour. Then the tanning liquor is added in portions of one gallon at a time at intervals of one-half hour, and the drumming continued for three or four hours, or until the sides are tanned. Three gallons of tanning material are usually sufficient for each hundred pounds of stock in the drum, although it is always economy to use plenty of liquor, even more than is necessary in order that the leather may be thoroughly tanned. To finish the tanning from one pound to one and one-half pounds of salts of tartar should be dissolved, and added to the contents of the drum, after which the drumming should be continued for three quarters of an hour. The tanning should now be complete, but in case of any doubt in the mind of the tanner the sides may be run in the drum longer, and they may also be allowed to lie in the liquor some hours.

When thoroughly tanned, the sides may be removed from the drum and thrown over horses so that they are smoothed out and allowed to press and drain for some hours; then they should be washed for one-half hour in borax water—two pounds of borax used in sufficient water for every one hundred pounds of leather—and then in clean water for one hour, or until the leather is perfectly neutral and clean. Any good chrome process may be used in making chrome upper from cow-hides. The leather may be made by tanning the sides in vats with paddles, or with rockers, in the same manner that they are tanned in bark or extract liquors, by being started in a weak liquor two or three per cent., that is two or three gallons of tanning liquor added

to one hundred gallons of water—and by finishing up in a strong liquor, six or seven per cent. Heavy sides may be shaved after tanning and retanned if necessary.

When the tanning, or the retanning is completed, the sides should be very thoroughly washed, first in borax water for thirty minutes and then in clear water for another half hour. When a two-bath or acid process has been used in tanning the sides require a more thorough washing than when a one-bath process has been used. After the washing in borax water—one pound of borax used for every one hundred pounds of leather—the sides should be washed for one hour in clear water, in order to remove all traces of acid which, when it is left in the leather produces undesirable effects.

When the washing is completed the sides should be struck out by hand or on a machine, or they may be pressed, and the surplus water removed from them. In order that the leather may be of uniform substance and smooth and clean upon the flesh, it may require a shaving; but whether sides require shaving or not depends upon their condition and must be decided accordingly.

It is an advantage to the leather at this point to give it a treatment with Palmetto extract. This has very good effects upon the stock, not only helping to make firm, close-grained leather but also serving as a mordant for the dye and increasing the depth of the black. For one hundred pounds of chrome leather about one pint of the extract may be used, dissolved and mixed with ten gallons of water at a temperature of ninety degrees, and the leather milled in the solution for twenty minutes.

The directions for flesh coloring, fat-liquoring and grain blacking, drying out and finishing given as applied to calfskins, work equally well when applied to side leather. It is not necessary to repeat the descriptions of the processes here. The formula given for a fat-liquor to use upon heavy calfskins produces good results upon side leather. To color chrome sides fancy shades, the directions as given for calfskins may be followed, by changing the quantities of dye-stuffs used.

CHAPTER XXIII.

THE COLORING, FAT-LIQUORING AND FINISHING OF HEMLOCK, GAMBIER, PALMETTO, QUEBRACHO AND COMBINATION-TANNED SIDES INTO SHOE LEATHER.

FOR the sake of convenience and in order to avoid repetitions, the above named classes of leather will be treated together, inasmuch as the methods of coloring and finishing described produce equally satisfactory results on each and all of the various tannages.

When the tanning, or the retanning, is completed, the sides may be washed to remove surplus liquor and then pressed for the same reason. Some tanners merely press the leather and do not wash it. After the pressing, the sides may be shaved if they require it and made of perfectly uniform substance. Then they are fat-liquored. In some cases the leather is first drummed in oil in the following manner: A pin-mill drum is heated to a temperature of about 100 degrees with steam, and one gallon of oil used for each one hundred and fifty pounds of leather, weighed after being drained and pressed. The leather is run in the oil for forty minutes, or until the oil is fully absorbed. Next the stock is taken from the drum and hung up and dried out. After drying the leather should be weighed and then moistened with warm water and then piled up for a number of hours to soften. Then it is put into the drum and run with just enough water to soften all parts alike, when it is ready for fat-liquoring. This is the method employed by some tanners, while others fat-liquor their leather, immediately after it has been drained and pressed. As a fat-liquor any one of the following formulas produces good results:

Fat-liquor formulas.

1. Five pounds of potash soft soap, and one gallon of Møllon degreas, boiled and made into an emulsion with one-half barrel of water and steam. This amount of fat-liquor is sufficient for four hundred pounds of leather.

2. Twenty-five pounds of potash soft soap are boiled and stirred until thoroughly dissolved in twenty-five gallons of water. Then about fifty pounds of English sod oil and one and one-half gallons of neatsfoot oil are poured into the soap solution and thoroughly mixed together. A few pounds of degreas may also be added. Enough cold water is next added to make a total of fifty gallons of fat-liquor. Twenty gallons of this fat-liquor are required by each one hundred pounds of dry leather. The quantity to be used, however, depends upon the nature of the tannage. A smaller quantity will, in some instances, produce the desired softness, some tannages requiring less fat-liquor than others.

3. Ten pounds of soap boiled in fifteen gallons of water, until dissolved. To the soap solution are added four gallons of neatsfoot oil, and ten pounds of degreas, and the ingredients are thoroughly mixed together. Enough water is then run in to make fifty gallons of fat-liquor.

4. Twenty pounds potash soap and forty pounds English sod oil, boiled and saponified. About twelve gallons of this fat-liquor may be used for every hundred pounds of leather.

The pin-mill drum should be heated with live steam to a temperature of one hundred and twenty degrees. If the leather has been dried out it should be uniformly moistened with warm water before it is fat-liquored. This, of course, is not necessary when the leather is fat-liquored before it has been dried out. Any excess of moisture should be guarded against both in the drum and in the leather, for it retards the proper absorption of the fat-liquor. The fat-liquor should be added to the leather in portions of one or

two gallons at a time through the hollow gudgeon of the drum, and after all the fat-liquor is in, the leather should be drummed for forty minutes, or until all the fat-liquor has been absorbed. Upon being taken from the drum the leather should be washed in clear water, lukewarm, to free it from particles of leather fibres which occasionally spot the leather, and then left to drain well before it is dried out, thus letting the grease penetrate through every fibre. Then the leather is dried out.

Coloring the flesh of side leathers.

In most instances the leather is fat-liquored twice, the second application of fat-liquor being given after the leather has been colored. When the leather is dried out, after the first fat-liquoring, it is moistened and sammied, and then colored blue or purple or yellow upon the flesh as may be desired. The flesh coloring for yellow back may be done in the following manner: The leather is moistened uniformly with warm water, and placed in a pile for twenty-four hours to become soft. Then one-half pail of sumac is scalded for two hours in a closed vessel. To the prepared sumac are added four pails of water and one gallon of Lactracine. This quantity of liquor suffices for sixty medium sides. It is used at a temperature of 100° Fah., and the leather drummed therein for twenty-five minutes, when it is ready for the yellow dye. Various materials may be used to color the flesh yellow, Yellow S being a satisfactory article. One pound of the same is dissolved in half barrel of water and applied to the leather at a temperature of 100 degrees. Then the leather may be dyed black upon the grain, oiled off and dried out. Blue backs are more popular at the present time than yellow backs. To obtain a deep blue color upon the flesh with nigrosine, eight ounces of the same are used for each dozen sides. The dye is boiled until it is dissolved, and the leather drummed therein for twenty minutes. Then the

leather is grain blacked and dried out. A flesh coloring may also be prepared of logwood liquor, nigrosine black and methyl violet aniline. Logwood and sal-soda or borax also make a good liquor for the purpose.

The methods of dyeing the grain black are fully described in the chapter on chrome upper leather. The formulas and directions given work equally well on vegetable tanned leathers. After dyeing the grain is washed off, the leather struck out, a light coat of oil applied evenly over the grain and the leather dried out. After drying it may be finished in any way desired.

The following are also practical formulas for the making of fat-liquors

Suitable to side leathers. Ten pounds of degreas, two gallons of sod oil, two gallons cod oil, three pails soft-soap, two pounds of borax and three pails of water for each forty-five sides of leather. Also for each one hundred pounds of dry leather may be used, five pounds French degreas, three pounds cod oil, three pounds neatsfoot oil, and two pounds paraffine oil. After fat-liquoring, the sides should be dried in a warm room and are then ready for coloring and finishing. If the leather is intended for dull or kangaroo finish it should be blacked before being set out; if a bright glazed finish is to be applied the leather should be set out and dried before it is blacked. The setting out should be very thorough and hard.

Effects of different oils and greases on leathers.

Different effects are produced upon leather by the various oils and greases used in stuffing or fat-liquoring. Animal and fish oils have been used for a great many years, and they impart a full, mellow feel to the leather, as well as giving it strength and softness. Neatsfoot is the animal oil generally used, while of fish oils cod or sperm are largely employed. Another class of oils used upon leather are mineral oils. These make the leather soft and pliable,

but they are soon evaporated leaving the leather harsh and brittle. It is well known that the durability and texture of leather are largely determined by the class of oil or grease used upon it. Some oils make the leather soft so long as it is new, but the softness is not permanent, and as the leather ages it becomes dry and harsh. Animal and fish oils are liable to become rancid in the leather, thus causing the fibres to rot and destroying the strength of the leather. Sometimes the leather acquires a disagreeable odor from such oils; and white grease spots and scum frequently appear upon the surface of the leather caused by the chemical changes taking place in the stock.

The best oils to use are the good grades of animal and fish oils. The best quality only should be used, and although they do not penetrate so readily as mineral oils, they nourish the leather better, and by becoming thoroughly incorporated with the fibres give lasting strength and softness to the leather.

Chrome leather retains its softness as long as it lasts, not only because it is chrome tanned but because the oils and soaps used in lubricating it become thoroughly incorporated with it and because a good quality of these materials is generally used. Leather should be greased only with those greases that adhere strongly to the fibres. Glycerine imparts no great softness to leather. Its chief use is to give to the grain a smooth, soft feel, which helps in the final finishing.

FAT-LIQUORING WITH Mulsine.

Mulsine is a compound for making fat-liquor. It needs to be mixed only with water when it is ready for use at once without the addition of soap, alkali or any other material. By its use the tanner is saved the trouble of buying soaps and oils, which do not always run uniform and of mixing the same. It contains no sticky or resinous matter, and is so compounded that no free oils or alkalies are car-

ried into the leather, thus insuring freedom from sticky or oily grain, and spew upon the finished stock, provided no mineral acids remain in the leather after it is tanned. These results are not always obtained when saponified fats are used. The fats used in making many of the fat-liquors in common use by the ordinary process of saponification with soap, potash and soda are converted into soap in the leather by the excess of alkali, and this is detrimental to the fibre, and owing to the fact that this soap works out readily, the leather ultimately becomes dry and hard.

Mulsine is antiseptic in its nature and will not deteriorate whether in solution or in the leather itself, while ordinary fat-liquors turn sour when allowed to stand in warm weather before using, thus proving the deterioration of the ingredients. Mulsine remains sweet at all times. It is thoroughly blended and aged, and therefore much more efficient than fat-liquor stock prepared immediately before using. Mulsine leaves no stain or oil spots and permits the leather to bleach uniformly. The finished stock is bright in color, and the grain is soft, strong and fine. Mulsine is very useful in making patent and enamelled leather, making the same soft and full, yet firm and well nourished, thereby permitting it to be successfully buffed. The leather will enamel readily and the enamel will hold, and after baking will not show blisters or grease spots. In preparing a fat-liquor with Mulsine the material is dissolved in boiling water in the proportion of one gallon of the same to three gallons of water boiling hot, then cold water is added until the mixture is in the proportion of one gallon of Mulsine to four gallons. In other words when ready to use the fat-liquor should always be composed of one gallon of Mulsine and four gallons of water. The proportions should always be determined by actual measure. Seven and one-half pounds can be called one gallon, if measure is made by weight.

After the leather has been split, retanned, pressed and

shaved it should be uniformly sammied and then weighed to ascertain amount of fat-liquor to be used. The pin-wheel should be heated to 125 deg. F., and the leather put in with a small amount of water also heated to 125 degrees F., and milled until the moisture is evenly distributed and the leather pulled. The fat-liquor will then be rapidly and evenly absorbed. An excess of moisture should be guarded against, either in the mill or in the leather itself, for it will prevent the proper absorption of the fat-liquor.

The fat-liquor prepared as suggested should be used at a temperature of 125 deg., Fahr. The pin-wheel should be heated to the same temperature before the fat-liquor is put into it. The fat-liquor should be added through the gudgeon of the drum while the same is in motion. A running for thirty minutes will enable the leather to absorb all the fatty matter in the liquor, provided no mineral acids are left in the leather after tanning, and the fat-liquor and leather have been prepared and used according to these instructions.

Upon hemlock and other vegetable tanned stock, and upon combination tanned side, kip and calf leather, imitation kangaroo, and upon dull and glazed boarded grains, for the first application of the fat-liquor thirteen gallons are used for each one hundred pounds of stock. For Russia leathers eleven gallons of fat-liquor are used for each one hundred pounds of stock.

After the leather has received the first application of fat-liquor it should be rinsed off in clean warm water at 100° F., to free it from particles of leather fibre and fleshings, which containing oil would spot the leather while it was drying. Before the stock is hung up to dry it should be placed on a horse for about four hours, which will allow it to drain and the fatty matter to assimilate with the tannin in the leather and penetrate while warm into the stock. This will avoid chilling the oils on the surface, which would occur without these precautions. After the

stock has been dried it should be weighed again to determine the amount of fat-liquor to be used in the second application, and then put into a tub with water at a temperature of 110 degrees until thoroughly soft. Then it should be placed in a pile for twelve to fifteen hours to sammie. The quantity of fat-liquor used in the second application should be ten gallons for each one hundred pounds of stock, for imitation kangaroo and dull printed grains. These leathers are generally yellow-backed before the second application of fat-liquor.

For blue-back, glazed and boarded black grains seven and one-half gallons of fat-liquor should be used for each hundred pounds of leather. These leathers are usually blue-black before the second application of fat-liquor, and are blacked upon the grain afterwards.

For Russia leather four gallons of fat-liquor should be used for each one hundred pounds of stock. Black Russia is usually blue-backed, and colored Russia leather is usually bleached, mordanted and colored before the second application of fat-liquor. Upon russett, bag and strap leather ten gallons of fat-liquor are used upon each one hundred pounds of stock. Patent, enamelled, and tipping leather are given fourteen gallons of fat-liquor for each one hundred pounds of stock.

Fat-liquoring chrome leather with mulsine.

When it is intended to be used upon chrome leather, the fat-liquor should consist of one gallon of Mulsine in seven gallons of water. It should be at a temperature of 125 degrees when used. For all shoe leathers excepting sheepskins eight gallons of fat-liquor are used for each hundred pounds of stock, weighed directly after being shaved. For sheepskin shoe leather two gallons of fat-liquor are used upon each hundred pounds of leather; for sheepskin glove leather one gallon upon each dozen skins, averaging twenty pounds per dozen before being tanned.

For calfskins, tips and sides for glove leather ten gallons of fat-liquor are used for each one hundred pounds of stock, tanning weight.

CHROME-TANNED SIDE GLOVE LEATHER.

For either glove or shoe leather, the sides should be well limed and bated thoroughly so as to get the desired softness and pliability. After coming from the bating process, and having been washed off in warm water, the sides should be pickled in a solution of salt, sulphuric acid and water. About two and one-half quarts of acid and fifty pounds of salt in sufficient water to cover the stock will pickle fifty sides of medium size. In this pickle the sides should be stirred about for some eight or ten hours, and then allowed to drain well before they are tanned. The sides after pickling and draining should be weighed; and for each one hundred pounds of sides a solution is prepared in the following manner: Three pounds of sulphate of alumina are dissolved by boiling in five gallons of water. Also in another vessel are dissolved by boiling in five gallons of water, three pounds of sal-soda. The solution of sal-soda is poured slowly and with constant stirring into the sulphate of alumina solution. The two solutions combined form a milky white liquor, which should not be used until it has become cool, or enough water should be added to it to reduce the temperature to about eighty-five degrees.

The pickled sides are thrown into a pin-mill drum with a solution of salt, ten pounds of salt dissolved in five gallons of water for each one hundred pounds of pickled stock. In this solution the sides are milled for about fifteen minutes, or until they are thoroughly wet through and opened out. Then the solution of alumina and sal-soda is added, preferably a portion at a time until it is all in, after which the drumming should be continued for one hour. Then for each one hundred pounds of stock in the

drum, one gallon of one-bath tanning liquor (Tanolin) is added, and at the end of one-half hour another gallon, and at the end of one hour another gallon is added, making in all three gallons of tanning liquor for each one hundred pounds of sides in the drum.

The drumming in the tanning liquor usually consumes about four hours, although this depends upon the thickness of the stock. After the sides are well struck with the tanning liquor, in about one gallon of water should be dissolved one pound Salts of Tartar for each one hundred pounds of leather. This is added to the contents of the drum and the drumming continued for one-half hour, at the end of which time the sides will be found to be tanned. If any doubt exists as to the stock being thoroughly tanned, it may be run in the drum an hour or two longer, and the leather may be allowed to rest in the liquor over night. Then the leather may be removed from the drum, and left in piles to press and drain for about twenty-four hours. After pressing and draining this length of time the leather requires to be thoroughly washed. This is done by drumming it in a solution of borax, using two pounds of borax mixed in solution with sufficient water, for about thirty minutes, and then it is washed in a washing drum so arranged that the water may run on and off the leather continuously. The washing process should consume about one hour, and the leather should be perfectly neutral to the taste. It is then ready for striking out or pressing, coloring, fat-liquoring and finishing.

CHAPTER XXIV.

HORSEHIDES AND COLTSKINS.

THE methods used in working horsehides and coltskins through the processes of the beamhouse are not materially different from those employed upon other classes of hides and skins. Horsehides and coltskins are soaked, softened, unhaired, limed, bated and washed in the usual manner. Nevertheless a few suggestions especially applicable to this class of stock will not be out of place here. Green salted hides and skins require but a short soaking in warm weather, provided the water is fresh and clean and the stock is not excessively salty or dirty. A soaking for eighteen to twenty-four hours is usually sufficient, although no great harm comes to stock when it is soaked longer. Time is money to the tanner, and hence it behooves him to work his stock through as rapidly as possible. Dry coltskins, such as come from Russia, require a thorough softening. To hasten the softening sulphide of sodium may be added to the water in which the skins are soaked, or salt water may be used instead of the sulphide soak. When sulphide of sodium is used, about one-fourth of an ounce is sufficient for each skin. The material should be dissolved and added to the water before the skins are put in. The results of its use are that the skins become thoroughly soft, and freshened up in grain and fibre in a much shorter time than when it is not used. Another good way to soften the dry skins is by the use of common salt. The quantity of salt required is not fixed. More or less may be used, but only enough to give the water a salty taste, and the water should be clean and fresh at the start. After the skins have become soft in the brine, they should be washed or

soaked in clean water before being passed into the unhairing process. By the use of either of these methods soft clean skins are obtained in a comparatively short time. Old stale soaks are often used by tanners, but their use cannot be recommended. Much brighter, clearer grained and softer skins are obtained when clean fresh soaks are used.

In using sulphide of sodium upon horsehides for the purpose of removing the hair, a good way to use it is to paint the hides with two liquors of different strengths. Upon the fore part a liquor of twenty degrees Baumé may be used, and a twenty-four degree liquor on the shell. By using the sulphide of sodium in this way the shell is softened and the time of liming is shortened. A mixture of lime and sulphide of sodium may be used, or a sulphide liquor alone. In a few hours the hair will be loosened, but it is best not to remove it until the next day, as by that time it will come off cleaner and more readily. A further liming for from four to six days in weak clean limes is all that is required for stock treated in this way for shoe leather, while for glove and mitten material a longer liming is usually required in order to get the stock sufficiently soft and elastic. Sulphide of sodium may also be mixed with the lime in vats and the stock treated in the manner that has already been described under other headings. Red arsenic may be also used in the same manner as upon calfskins, and the grain made soft and fine by its use. For glove leather a longer time is allowed in the limes than for shoe leather.

The use of lactic acid

While there are various methods of bating and drenching hides and skins in common use, no article is better than lactic acid for the purpose of removing the lime and preparing the skins for tanning. Upon horsehides and coltskins, for both glove and shoe leather, it is used in the fol-

lowing manner: For every one hundred gallons of warm water in the paddle-wheel use one gallon of lactic acid. Sometimes three quarts will do the work. After the stock comes from the liming process and has been fleshed, it should be washed in warm water, and then drenched in the acid liquor prepared as above. The time consumed by the process varies from one to three hours. The temperature of the drench should be about ninety degrees. The lime can be thoroughly neutralized in one bath, and when the hides or skins are taken out they may be worked on the beam or slated, and then rinsed off in warm water and pickled or tanned. For some purposes, and for some processes of tanning it is necessary to pickle the stock in a liquor composed of salt, sulphuric acid and water, as will be explained later on. For alum tawed leather, also some processes of chrome tanning, pickling is not necessary. However for the alum process the hides or skins are considerably bleached and whitened by the pickling process but the acid should be removed from the stock before it is tawed.

Whip and baseball cover leather

Whip leather, and leather for baseball covers and similar purposes may be made by the following processes: After the stock has been bated or drenched and is ready for tanning, it is treated to a solution of sulphate of alumina and salt, made up of three pounds of the former and eight pounds of the latter dissolved in five gallons of water for each one hundred pounds of skins. If the stock has been pickled to preserve and bleach it, the acid pickle should be removed by a drench in sour bran and salt. The stock is drummed in the sulphate of alumina and salt solution for thirty minutes. Then for every hundred pounds of stock ten pounds of hyposulphite of soda are dissolved in five gallons of water and added to the contents of the drum. In this liquor the stock is drummed for another thirty minutes, at the end of which time the tawing will be made

permanent. This would complete the process were it not that the solution of hyposulphite of soda makes the stock thin. To overcome this, another solution of sulphate of alumina and salt is added to the contents of the drum. This may consist of two pounds of sulphate of alumina and six pounds of salt for every one hundred pounds of stock. A further drumming in the combined liquors for thirty minutes completes the process, which results in well-tawed leather of smooth fine grain, tough and to a great extent insoluble. Leather made in this way resembles chrome leather and may be finished in the same manner as chrome leather, or by any method usually employed on alum leather.

Tough leather of light color

Very tough leather of a light color is made by combining an alum and a chrome process. In the beginning the stock is drummed for thirty minutes in a solution of sulphate of alumina and salt, composed of three pounds of the former and eight pounds of the latter, dissolved in eight or ten gallons of water. At the end of thirty minutes the chrome liquor is added to the stock. Usually three gallons of liquor are required by each one hundred pounds of stock. This should be divided into three portions and mixed with an equal volume of water. The portions of one-third each are given to the skins at intervals of one-half hour, and the leather drummed in the combined alum and chrome liquor for three hours or until it is thoroughly tanned, after which it should lie in the liquor for twenty-four hours, then be thoroughly washed for at least thirty minutes, fat-liquored and dried out without coloring. The leather dries out nearly white. Good leather can also be made by taking the stock from the drum, after the drumming in alumina and salt and drying it out. After drying it may be moistened back and given the chrome liquor. In this process the benefit of the alumina treatment is obtained as well as

the chrome, and the leather possesses the good qualities of both classes of leather.

Very soft and tough leather may be made by the use of a form of the old calf-kid process.

In this method the stock is treated to a solution of three pounds of sulphate of alumina, eight pounds of salt, five pounds of flour, five quarts of egg-yolk and three quarts of neatsfoot oil for each one hundred pounds of stock. The skins and the liquor should be warm when put into the drum, and the stock should be milled in the solution for at least one hour, after which it may lie for a day or two in a cold alum solution, and then be dried out in a warm room. The leather is then dampened and staked by hand or machine. For first-class leather the stock may be laid away for several weeks after the tawing is completed in order that it may retain all the tawing materials, and result in soft plump leather.

Horsehide shoe leather.

For shoe leather from horsehides and coltskins the gambier tannage is well adapted. Quebracho is also used, also Palmetto extract and the stock is also tanned in combinations of two or more tannages.

Russia coltskins may be tanned in the same manner as calfskins intended for Russia calf, either black or colored. For this gambier is used, either alone or in conjunction with alum and salt, forming a kind of dongola process. When the tanning is done in one liquor the action of the paddles keeps the skins in motion and thus secures an even tannage. The alum and salt may be used with the gambier or the process may be used as a two-bath process, the skins being first given the alum and salt, and then the gambier. The following instructions regarding the use of Palmetto extract may be of interest. After the hides or skins are ready for tanning they should be kept in a cold

palmetto liquor of a strength of four degrees barkometer, until well colored in the paddle-wheel. Then they are run in the paddle-wheel for one and one-half hours and then the leather is put into drums with the extract at thirty degrees, heated to a temperature of seventy or eighty degrees, and in six hours the leather is tanned. Upon coming from the tanning liquor the leather should be washed in lukewarm water. It will be found to be soft and smooth grained and with firm well-filled flanks. The water in which the leather is washed contains much coloring matter and may be used as a coloring liquor in the paddle-wheel. Good leather is also made by a combination of a chrome and vegetable process. When this is done the hides or skins are started in a chrome process and then finished up in gambier or some similar tannage. When a one-bath chrome process is used the stock is drummed or paddled until it is well struck with the tanning liquor, then it is washed and placed in the vegetable liquor. This is a good method to use in tanning Russia coltskins.

When the tannage is completed the stock is removed from the liquor and pressed to remove surplus liquor, and then left in piles for a number of hours. To get the desired softness and pliability the following fat-liquor produces good results. Twenty-five pounds of potash soap are boiled until thoroughly dissolved. Then about fifty pounds of English sod oil and one and one-half gallons of neatsfoot oil are poured into the soap solution and the two ingredients are completely mixed together. Enough water is next added to make fifty gallons of fat-liquor. Before this fat-liquor is used the leather should be drummed in oil, about one gallon of oil being used upon every hundred pounds of leather weighed after pressing. After drumming in the oil the leather is hung up and dried out, and then moistened down for fat-liquoring. The moistening of the leather must be uniform so that it will be evenly moist and soft. A suitable pin-mill drum should be heated to about one

hundred and twenty degrees, the leather thrown in and run a few minutes until it is warmed up. Then the fat-liquor is added and the leather drummed for at least thirty minutes in the fat-liquor until the grease is all taken up, then the leather should be hung up and dried again.

For dongola, combination, and gambier tanned Russia coltskins and horsehide leather for shoe purposes the flesh may be colored yellow in the following manner :

The leather, dried after fat-liquoring is moistened with warm water and left in piles until it is uniformly soft and moist. One-half pail of sumac is scalded for two hours in a closed vessel. To this are added four pails of water and one gallon of Lactracine. This quantity of liquor is sufficient for one hundred and fifty colt-skins. The liquor is used at a temperature of one hundred degrees, and the leather drummed in the liquor for thirty minutes. Then the leather should be thrown back upon the sides of the drum and the color solution added. This may consist of one pound of Yellow S, dissolved and boiled in one-half barrel of water. Three pailfuls of this liquor are required by each one hundred pounds of dry leather. A drumming for ten minutes is sufficient to allow the leather to absorb the dye, after which the grain is blacked, oiled and the stock dried out.

When a blue flesh is wanted

The leather is drummed in a solution of logwood, blue aniline and sal-soda for twenty minutes, then removed from the drum and the grain blacked by hand or machine. After grain blacking, the leather is well struck out, oiled lightly and dried out. Then it is moistened back, staked, dried and staked again, and is then ready for the final finish which may be either dull or bright. For the dull finish the leather is seasoned with a dull finish, and while in the moist condition it is ironed. For a bright glazed finish season the leather with the following solution : One-

half pint blue stone, one-eighth ounce iron, one-half pint logwood, one pint blood, one-half pint nigrosine. This glazing liquor is applied evenly to the grain of the leather and well rubbed in, after which it is dried and glazed. Two or three coats of the seasoning are generally required.

A seasoning liquor for a glazed finish may also be made of these ingredients: Five gallons of logwood are blacked with five ounces of copperas. Or in place of such a liquor a solution of black nigrosine may be used. Then add one and one-half pints of blood, five ounces of glycerine and eight ounces of ammonia. After the first coat of seasoning has been applied, the leather dried and glazed, a liquor composed of lactic acid, water and bichromate of potash, may be applied and well rubbed in. This removes grease and helps to deepen the black. In place of lactic acid and bichromate of potash, a dilute solution of vinegar and bichromate of potash may be used. Mix one gallon strong vinegar, one ounce of bichromate of potash and five gallons of water. Apply between the first and second glazing to clear the grain and deepen the color.

Horsehides intended for glove leather

Should be thoroughly limed, and bated low at the beginning in order to get the desired softness in the stock. Soft tough leather which does not tear readily, and which resembles oil tanned stock is made by applying the Napa tannage of oil and soap to horsehides. The hides may be pickled before tanning, as this bleaches them. Upon coming from the beam-house, the hides are immersed in a solution composed of the following ingredients, for each one hundred pounds of stock: Ten pounds of salt, fifteen pounds of potash in one hundred and fifty gallons of water. The skins remain in this liquor in a vat for three hours, or they may be drummed in a drum for something less than one hour, after which they are wrung out dry and treated to a solution of oil and soap—six pounds of hard soap, and two

gallons of neatsfoot oil in one hundred and fifty gallons of water. The stock should be left in this solution, which should be thoroughly emulsified before it is used, until it is wet through, and then hung up and dried out. The process may be repeated two or three times until the leather is sufficiently soft and well tawed. A washing in warm water is necessary after the last drying out to remove surplus of tawing materials, after which the leather may be smoked, colored, or dried out white and worked until it is soft enough for use.

Another process.

A process slightly different from the above consists of a first liquor of two pounds of caustic soda, and one pound of borax in sufficient water to cover the hides. This solution and the stock are placed in the drum and milled for thirty minutes to one hour. The hides are then removed from the drum, hung up and dried out. They are next immersed or drummed in a solution composed of five pounds of hard soap, one gallon of straits or neatsfoot oil, and one-half pound caustic soda. This liquor should thoroughly impregnate the stock before it is dried out; and after drying the process may be repeated as often as is considered necessary. After the stock has been treated in this manner and become leather it may be put into a very weak solution of soap, oil and caustic soda thoroughly mixed with water, in order to soften it, and in this moist condition it may be smoked, colored or left without coloring or smoking and dried out white.

When the hides are not treated with acid, the full strength of the fibres is retained and the leather is consequently very tough and strong, and free from any tendency to crack or break.

Another process for glove and mitten leather.

Glove and mitten leather may also be made from a solution or tanning mixture made up of seven pounds of alum

or of sulphate of alumina, three pounds of glauber salt, four pounds of rock salt, ten gallons of water, eight pounds of ground sumac, one pound of ground nutgalls, and four ounces of sulphuric acid. In preparing the mixture, the alum, salt and glauber salt are reduced to a powder and boiled in the water until they are all dissolved. The sumac and nutgalls are also boiled briskly for thirty minutes, and then strained over the other liquor and mixed with it, and the sulphuric acid is next added. The liquor is used at blood heat, and the stock treated therein for a period of twenty-four to thirty-six hours, being stirred about for one hour, and then allowed to rest in the liquor for the remainder of the time, with occasional stirring. The process can also be applied in drums, the stock being drummed for two hours and then allowed to rest in the liquor for a number of hours. Upon coming from the liquor the leather should be given a thorough striking out with a glass slicker. This is followed by a moderately heavy coat of lard or neatsfoot oil applied to both sides, then the stock is hung in a warm room and dried out, which completes the process. The leather is, to quite a degree, impervious to moisture. Before the oil is applied, it should be warmed, and the water should be well struck out of the skins. The leather should be worked as it dries and the drying and working continued until the stock is thoroughly dry and soft.

Horsehides may be made into excellent glove material by the use of chrome methods of tanning. The one-bath method is very simple to use and results in making leather in every way as good as two-bath tanned stock. After bating or drenching, the hides may be pickled in a solution of salt, sulphuric acid and water, two and one-half quarts of acid, and fifty pounds of salt, making a liquor of sufficient strength when mixed with one hundred gallons of water, to pickle two to three hundred pounds of stock. The pickling process consumes about six hours, and at the end of this time the stock may be removed from the liquor

and well drained before it is tanned. For each one hundred pounds of stock, weighed after draining, prepare a solution of one pound of glauber salt in eight gallons of warm water (85 degrees). Throw this solution into the drum with the pickled stock and mill the same for fifteen minutes. The stock is next thrown up on each side of the drum, the plug pulled out and the glauber salt solution drained off. Then replace the plug and throw into the drum ten pounds of common salt, and eight gallons of water for each hundred pounds of stock and mill for five minutes. Then add to the contents of the drum, one gallon of the tanning liquor (Tanolin) for each hundred pounds of stock and mill for one-half hour, then add another gallon tanning liquor and mill for one hour, and finally add another gallon of the tanning liquor for each hundred pounds of stock and continue the drumming for two or three hours, or until the stock is well struck with the tanning material, making three gallons of tanning liquor used for each hundred pounds of leather. Dissolve in a little water one-half pound bicarbonate of soda for each hundred pounds of stock, add to the contents of the drum and run the drum for three-quarters of an hour. If the liquor in the drum still shows a deep green color add another one-half pound of soda and continue the drumming for one-half hour longer. The tanning should now be completed, but if any doubt exists the stock may be drummed for a longer time, or it may be allowed to rest in the liquor over night. When thoroughly tanned the skins may be removed and allowed to press and drain for twenty-four hours. After pressing and draining the required length of time the leather is thrown into a drum with a solution of borax or bicarbonate of soda, using two pounds of borax for each hundred pounds of leather and milled in this solution for one-half hour. On removing the leather from the borax water it should be washed in clear water. It is not necessary to wash it for a great length of time as is required

when sulphate of alumina, alum or hyposulphite has been used in tanning. The leather, after washing is ready for shaving, coloring and fat-liquoring.

The leather can also be made by treating the stock as it comes from the bating and drenching and without pickling it, treating it with a solution of sulphate of alumina and salt, using three pounds of the former and eight pounds of the latter in six gallons of warm water for every one hundred pounds of leather. After drumming the stock in this solution there should be added at intervals of one-half hour, and in quantities of one gallon at a time, three gallons of concentrated one-bath liquor. After the liquor is all in, the leather should be drummed for three hours, at the end of which time it will be completely tanned. It should then be washed for at least thirty minutes and will then be ready for coloring and finishing.

Leather tanned in either of these ways may be readily colored any shade. The quality of the material is somewhat improved by slightly retanning it with either sumac or palmetto extract. This also prepares it for coloring, and makes the grain tough and fine and yet soft. The same fat-liquors may be used upon glove leather as upon shoe material, more being usually given to the former than to the latter, in order to make it soft. A coat of oil applied to the grain before the leather is dried out, toughens it, makes it soft, and gives it a smooth silky feel. Neatsfoot oil is generally used.

Horsehides tanned in oil.

Horsehides tanned in oil make exceedingly soft and durable leather, very useful in making gloves and mittens. When they are intended for any process of oil tanning they should be very thoroughly limed and bated and made perfectly clean and neutral. One method of oil tanning may be carried out in the following manner: After bating and washing, the hides should be pressed or slightly dried so as

to remove all excess of water and still leave them moist. They may then be given a thorough beating by means of an apparatus or machinery especially designed for the purpose in order to soften them, after which they are sprinkled with cod oil and are again beaten in order to force the oil into the leather. The highest grade of Newfoundland cod oil is considered the best for the purpose. The process of oiling and beating the leather is repeated two or three times or until the hides have assumed a mustard color, and have lost their original odor. After the oiling and beating are completed the leather is made to undergo a process of heating. By this process the oxidation of the oil which was begun during the previous process is completed by the fermentation that takes place. The heat is generated spontaneously and the piles of leather must be closely watched and frequently handled and turned over. The highest temperature allowable is 140° Fah., a higher temperature than this seriously damages the leather. All organic matter is destroyed by the heat. Unless sufficient heat is generated to kill the organic matter the hides will rot, and when there is too much heat present they become dissolved.

When the fermentation ceases and the leather is no longer susceptible of heating it is treated in a manner calculated to remove any excess of oil. This is done by washing it in hot water and then subjecting it to great pressure by means of a hydraulic press. A great deal of grease is squeezed out in this way. The oil may also be removed by washing the leather in a solution of soda ash which causes the grease to saponify. The saponified oil removed by pressure is neutralized with sulphuric acid and becomes the oil known as sod oil. A certain proportion of the oil must of course be left in the leather so as to give it softness. The finishing process consists of drying out the skins, and working the leather soft and smooth.

Oil tanning with Turkey-red oil.

In some instances the leather is hung up in a warm closed room, instead of being placed in piles to ferment. A species of oil tanned leather may be made by treating the prepared hides or sides to a solution of the soluble Turkey-red oils or alizarine oils, either in a drum or a vat. When vats or tubs are used the sides are pressed after bathing and washing and soaked in a twenty-five per cent. more or less solution of the oil, used at a temperature of 90 degrees. The oil can also be applied in a drum. After the treatment with oil, the hides are dried and placed in a heap for some time in a moderately warm room and covered up. They are then dried slowly in the open air, after which they are lightly washed and again treated with the oil in the same manner as at first. They are then placed in piles and allowed to heat, then dried out again and then washed in a weak solution of borax or other alkali. By drying and working the leather is made very soft and elastic. The results may be changed by greater or less concentration of the oil solution, by higher temperatures in drying, and by a greater number of applications of the oil. The leather may also be made by a combination of the oil with the salts of alumina. The preferred method of doing this is to soak the prepared sides in a solution containing preferably fifteen per cent. of the soluble oil, and then drying them out. This operation may be repeated, and then the ordinary method of tanning with alumina salts proceeded with in the usual way.

In any process of alum tanning in which egg yolk is used, Turkey-red oil may be used in place of the egg yolk with very beneficial results.

The removal of the grain, or the frizzing of the same is usually done on machines, after the liming process is completed.

CHAPTER XXV.

HARNESS, LINE, STRAP, BELT, BAG, CASE, LACE AND RUSSET LEATHERS.

IN this chapter a few suggestions will be given, which, although they are applicable to almost any kind of leather, have a direct bearing upon the classes of stock mentioned above.

The methods of preparing hides for tanning, the processes of tanning, and the methods of finishing the tanned leather, vary with every manufacturer. In a general way, however, the following method of preparing hides is a practical one and produces good results: The hides are soaked for at least two days, and three days soaking is sometimes required, the water being changed at least twice during the process. After fleshing and splitting the hides into sides, they are passed into the liming process. The lime is strengthened up with sulphide of sodium. For three thousand pounds of raw hide two hundred pounds of lime and twenty pounds of sulphide of sodium make a good fresh lime. For strengthening up this lime, seventy-five pounds of lime and ten pounds of sulphide of sodium may be used. In about five days the sides are ready for unhairing, and then fine-haired. The hides are then bated and washed and are ready for tanning.

Quebracho and hemlock.

For a safe, efficient and clean bate lactic acid is recommended. It readily dissolves the lime in the hides without injury to the color or quality of the leather, and by opening the pores of the hides makes them receptive to the tanning liquors. It is also very useful as a plumping agent. In the making of the classes of leather mentioned above

no better process can be used than a combination of quebracho and hemlock extracts. The hides, when they are ready for tanning are subjected to a liquor made up of about two-thirds quebracho and one-third hemlock. This combination can be used for tanning leather of almost any description. The time of tanning is reduced greatly, from the time required when bark liquors and lay-aways are used. The color of the leather is very fair and uniform, and no bleaching is required. The leather is well filled and yet soft and mellow. Quebracho extract liquors have some peculiar qualities, one of which is that they never turn sour, but always remain sweet. Leather made with quebracho alone is very pliable and tough rather than hard and firm. Hemlock supplements quebracho with excellent results. The color of quebracho tanned leather is an oak shade, inclining towards pink. The leather should never be dried in the sun, as this causes the color to become red.

Quebracho may be used in combination with almost any tannage. A pure quebracho liquor, however, lacks in plumping and filling qualities, and for this reason it is advantageous to first plump the hides before tanning them. The hides must be free from all lime before they are tanned in quebracho, since quebracho owing to its sweetness does not act upon the lime as bark liquors do, and this causes bad grain and color.

In testing the liquors for tanning strength,

The barkometer underrates the strength as compared with ordinary bark liquors. A pure quebracho liquor made up of nothing but quebracho extract and water of 20° barkometer, is fully as strong as a sweet bark liquor of 30° barkometer. This is because quebracho contains much less material that forces up a barkometer than does bark, and this fact and the variations must be taken into consideration or else a tanner will get the liquor too strong and burn the fibres of the leather.

Leather tanned with hemlock liquors

Is of a harsh nature, and does not carry black well. To tone down the harshness of the leather and to give it a softer, mellower feel, nothing is better than gambier. After splitting, the sides are milled in gambier in the following manner: Two hundred and fifty pounds of gambier are boiled in eighty gallons of water until dissolved. After skimming or straining, the liquor is ready for use. Ten gallons of the gambier liquor are put into a drum with thirty sides of average size, and two gallons of dry sumac are added, and sufficient water to make the leather wet without dripping. A milling in the liquor for thirty minutes completes the process; and better results are obtained in this way than if the hides are immersed for several days in a pit containing a strong liquor. Oak extract will answer the same purpose, and also palmetto extract. Hemlock tanned leather treated with either gambier, oak or palmetto extract as above suggested never grows rusty with age. The scouring, stuffing and finishing are then carried out in the usual way.

Palmetto tanned leather

Is soft, tough, well filled and of good color. The tanning of hides with palmetto extract may be carried out in the following manner: The tanning is begun in liquor 12° barkometer; the sides being nailed on sticks and suspended therein for about six days, during which time the strength is increased to 20° barkometer. The leather is then taken off the sticks and put into palmetto liquor 30° Baumé. In about six days with occasional handling the leather is tanned through. The leather is then pressed, shaved and split, after which it is put into weak palmetto liquor 12°, and then wheeled for a number of hours in 30° Bé. liquor until thoroughly tanned. The leather is now washed in lukewarm water and pressed, and fat-liquored. A good fat-liquor is made of five pounds of soap, and one gallon

and one pint of Møllon degreas, boiled together and used at a temperature of 120 degrees. The quantities of soap and degreas mentioned are enough for four hundred and forty pounds of leather. After fat-liquoring the leather is dried out, and then sorted according to the kind of finish to be applied. Harness and belt leather are stuffed after they are dried from fat-liquor with stearine at a temperature of 140° F.

Palmetto extract is useful as a retannage upon almost any kind of tanned leather, bringing it into condition to stand heat better, to carry more grease and thus become more waterproof and tougher.

LACE LEATHER

Leather remarkable for its great softness and strength and therefore useful as lace leather is made in the following manner: The hides are soaked, limed and unhaired in the usual manner, sulphide of sodium being mixed with the lime. After liming and unhairing the hides are bated and washed in the same manner as for other soft, pliable leathers. The tanning may be commenced in an old weak bark, oak or gambier liquor, the hides being left in it only long enough to become uniformly colored. The toughness of the leather is somewhat increased by supplementing a gambier tanning with alum and salt, coloring the hides well with gambier and then giving them the alum and salt. Upon coming from the tanning liquors the leather is dried. It may also be further tanned with oil and grease without being dried. Different processes of greasing the leather are used. A good stuffing mixture may consist of oil, flour, grease and salt. These are drummed into the leather by means of a pin mill drum, after which the leather is hung up and dried out. Degreas combined with oils and fats imparts great softness to the stock. After the leather becomes dried out the grain may be buffed off. It may also be removed before the hides are tanned. Setting out and working the leather complete the process.

Hides intended for lace leather

May also be tanned by the following composition: For every one-hundred pounds of hides—water, fifty gallons; alum, ten pounds; sal-soda, two and one-half pounds; common salt, three pounds; bran, from two to three pounds. These ingredients are made into a liquor, and the hides treated with the same, either in a vat or a drum; after which they are dried out. They are then split upon the splitting machine, and a mixture of lard oil and tallow applied, after which they are again dried out. The hides are then moistened and shaved, and the entire grain is removed in order to prevent cracking or breaking. A mixture of lard oil, one and one-half pounds; tallow, one-half pound; flour, two ounces for every ten pounds of hide; is then applied and well rubbed in; the leather dried again, and then worked and stretched.

Another tanning composition for lace and whip leather

Consists of twenty-five gallons of warm water; two pounds of alum; ten pounds of salt; one pound of sulphuric acid; two pounds of bran, and two ounces of dissolved sulphur. The hides are left in this solution for thirty minutes, and then one ounce of vitriol, four pounds of salt, two ounces of alum, are dissolved and mixed into the liquor. In this combined liquor the hides are tanned, and are then hung up and dried out. For lacing leather the hides are given a mixture of one pound of fish oil; one pound of tallow; four ounces of linseed oil and two ounces of soda soap dissolved in a gallon of hot water. The hides are then dried again and worked soft.

CHAPTER XXVI.

MISCELLANEOUS INFORMATION.

METHODS OF DEGREASING LEATHER.

IN the coloring and finishing of some kinds of leather, notably sheepskins and some kinds of goatskins, a great deal of trouble is encountered by the dyer and finisher in their efforts to get clear and uniform colors and a clear bright finish, owing to the grease in the leather. Sheepskins and some kinds of goatskins are naturally full of fat and grease. This is somewhat difficult to get rid of. In some instances, too, the leather, although not naturally greasy, is so over treated with oil or fat-liquor, as to make proper coloring and finishing almost impossible.

In removing the natural grease from skins, hydraulic presses are used. The skins are pressed immediately after liming, by being placed between the plates of a press and sprinkled with sawdust to prevent them from slipping. The pressure applied in this way is very great and large quantities of grease flow from the skins. While this method is good it is not always as effectual as might be desired. The skins are also treated with naphtha, both in liquid and gas form. Other methods are sometimes used, but they not only remove the grease but injure the life of the skins as well.

It sometimes happens that after leather is dried out and finished, the oil and grease in it, ferment and spew out upon the surface in the form of white grease spots, that not only destroy the appearance of the leather but injure the finish by dulling it, as well. Also when impure or low grade oils are used in giving to the leather suppleness and

strength quantities of gummy or resinous matter are deposited in the skins and these also have an unpleasant effect upon the quality of the leather. Leather must be free from uncombined oil and grease and dry upon the grain before satisfactory finishing can be obtained. Treating greasy leather with lactic acid before it is colored by drumming the leather in the acid in weak solution, and also by applying a dilute solution of lactic acid to the grain before the seasoning is applied is an effectual way of improving the clearness and brightness of the finish. Then there is a method of treating leather with naphtha by which every particle of unconverted oil or fat is removed. This method is applied to the skins after they have been dried out and before they are finished. The method of procedure is to immerse the skins in a bath of pure refined naphtha, preferably the ordinary commercial naphtha of about 70° Baumé, or other equivalent volatile hydro-carbon oil in a tank or close vessel, or drum, which either revolves or in which the skins are rapidly stirred or otherwise agitated, so as to insure rapid and thorough permeation of the naphtha. By processing the greasy leather in the naphtha, the latter becomes so fully saturated with the greasy and oily matter extracted from the skins that it will take up no more. To accomplish further removal of the grease the skins are removed to a second clean bath of pure naphtha and drenched therein as in the first case. The skins are subjected to a fresh supply of naphtha again and again, until the naphtha in which the skins are last placed remains pure, and so far unaffected thereby as not to show upon proper test the least trace of oil or grease.

When an impure or low grade oil has been used upon the skins, it is sometimes necessary to purify them and remove from them the gummy or resinous matters that have resisted the action of the naphtha. In such cases a drenching with alcohol, wood-spirit, ammonia or other solvents is required. After this treatment the leather is dried out

and finished in the usual way, and when it is glazed it is unusually bright and clear, and the fibres are remarkably tough, soft and strong.

A PATENTED PROCESS OF COLORING.

Ordinarily skins are not subjected to dyeing agents until they are tanned. A method, of which the following is a description, has been invented by W. F. Sykes, of New York City, by which skins are colored in the untanned condition and subsequently tanned by a chrome process. The coloring matters used in this process are sulphur derivatives, or compounds, such as the coloring matter derived by treating dioxybenzones, paradiamines or amido-phenols with sulphur and caustic soda, or those obtained by treating quinone, hydroquinone, toluquinone, or pyrocatechin with sulphur and ammonia. The group also embraces the analogous bodies known generically as "cachon de Laval," derived by treating certain organic substances with sulphur, caustic soda, and an organic acid, and embraces other sulphuretted coloring matters.

According to the ordinary procedure,

As for instance to produce a logwood black, the skin after being tanned according to one of the commercial and well-known acid or mineral tanning processes is submitted to several operations, which require the skin to be handled several times, before it is colored and dried out. These processes are well-known to those who are familiar with the making of chrome leather.

One of the known processes of acid or mineral tanning consists, essentially, in immersing the skins in chromic acid, and afterward reducing the chromic acid absorbed by the skins to chromic oxide, this being effected by the sulphurous acid gas generated in a second bath composed of sulphite, bisulphite or thiosulphite of soda or potash with a mineral acid as a decomposing agent. The chromic acid

may, however, be reduced and rendered insoluble in other ways, or the skins may be caused to take up a chromic salt direct, as in one-bath mineral tanning. It will suffice, however, to describe this invention in connection with the first of the mineral tanning processes referred to, which is well-known and widely practiced, and from this description it will be evident to persons skilled in the art of tanning that the process can be applied in connection with other chrome or mineral processes.

The skins are tested in the usual way, up to and including the process of slating. After this operation the skins are immersed in a bath of the desired one of the specified group of coloring matters or combinations thereof. The strength of this solution will depend on the shade desired, and on the volume of the dye bath, and other considerations as well understood by practical dyers. If, for example, the coloring matter be that known as "Vidal black," and if a full black color be desired, a two per cent. solution or thereabout, would be proper. These coloring matters produce all shades from a light gray, drab or slate color, to a deep black. After washing, the next step consists in the immersion of the skins in a chromic bath which fixes the color. Specifically this bath may be composed of chromic acid or of bichromate of potash and a mineral acid, or any one of the known baths in mineral tanning. The strength of this bath, and the period of immersion will be such as ordinarily employed in tanning the skins. If a chromic-acid bath has been employed, the next step will be the usual treatment in a reducing bath, such as sulphite, bisulphite or hyposulphite of soda, and an acid, whereby the chromic compound is rendered insoluble, and the tannage of the skins completed. The finishing operations are carried on in the manner commonly practiced. By this invention, the inventor claims to effect a saving in time, labor and materials, as well as of space. It is also claimed that dyeing with the group of colors specified previous to

tanning brings the skins into a better condition for the latter operation, than when the skins are subjected to the chromic bath immediately after slating; faster colors are produced than by ordinary methods; the colors are not affected by acids or alkilies; and the skins are made softer and more durable. By combining the colors various shades are produced. The skins may be dyed as described and then topped with an aniline or vegetable color.

SOAP RECEIPTS.

To prepare a soap useful in making fat-liquors,

And for any purpose for which soap is needed in making leather, the following practical recipe will be found of value: Take exactly ten pounds of double refined 98 per cent. caustic soda powder, put it in any can or jar with forty-five pounds (four and one-half gallons) of water. Stir it once or twice when it will dissolve immediately, and become quite hot. Let it stand until the lye thus made becomes quite cold. Weigh out and place in any convenient vessel for mixing, exactly seventy-five pounds of clean grease, tallow or oil, not mineral oil. A good plan is to use one-third grease, one-third tallow and one-third cotton-seed oil. When grease and tallow are used they should be heated slowly over a fire until dissolved and then mixed with the oil. If oil is used alone no heating is required. The temperature of the melted grease and tallow need not exceed one hundred degrees. Pour the lye slowly into the melted grease or oil in a small stream continuously, at the same time stirring with a flat wooden stirrer about three inches broad; continue gently stirring until the lye and grease are thoroughly combined and in appearance like honey. Do not stir too long or the mixture will separate itself again. The time required varies somewhat with the weather, and the kind of grease, tallow or oil used. From fifteen to twenty minutes is generally enough. When the mixing

is completed, pour off the liquid soap into any old square box sufficiently large to hold it, previously dampening the sides with water so as to prevent the soap sticking. Cover the box with old clothes or sacking, or better still put it in a warm place until the next day when the box will contain 130 pounds of soap, which can then be cut up into cakes with a wire. Remember that the chief points in the above directions must be exactly followed. The lye must be allowed to cool. The melted tallow and grease must not be more than warm when it is used. The exact weight of double refined ninety-eight per cent. powdered caustic soda and tallow or oil must be taken; also the lye must be stirred into the grease, and not the grease and oil added to the lye. If the grease or tallow used be not clean or contains salt it must be rendered or purified previous to use, that is to say, boiled with water and allowed to become hard again to throw out the impurities. Any salt present will spoil the whole operation entirely, but discolored or rancid grease or tallow is just as good as fresh for making this soap. If the soap turns out streaky or uneven it has not been thoroughly mixed. If very sharp to the taste too much soda has been used. In either case it must now be thrown into a pan and brought to a boil with a little more water. In the first case boiling is all that is necessary, in the other instances a very little oil or a very small quantity of the caustic soda must be added to the water. These things will never happen, however, if the directions are carefully and exactly followed, and after the soap has been made several times with the experience thus gained, the process is extremely easy and the result will always be a batch of good soap. Beef tallow makes the hardest soap, mutton fat a rather soft soap; of oils, cotton-seed is the cheapest and best, but the soap is somewhat soft and lathers very freely. It will be evident that a smaller quantity of the soap can be made at a time, according to the above directions, by taking the ingredients in exact propor-

tions. It is not advisable to make more than double the quantity prescribed, as it is difficult to work more by hand. By making successive batches one person can make two tons of this soap in a day with the apparatus, pans, etc., readily obtainable in an ordinary household. If the grease or tallow is perfectly clean and the oil light colored, the soap produced is quite white.

Potash soft soap.

To twenty pounds of clear grease take seventeen pounds of pure white potash. Buy the potash in as fine lumps as can be procured, and place it in the bottom of the soap barrel, which must be water tight and strongly hooped. Boil the grease and pour it boiling hot upon the potash: then add two pailfuls of boiling hot water and stir all together. The next morning add two pails of cold water and stir for half an hour; continue doing this until the barrel containing thirty-six gallons is filled up. In less than a week it will be ready for use. The borax or potash can be turned into the grease while boiling and also one pound of resin. The grease should be tried out and free from scraps, ham rinds, bones or any other debris; then the soap will be clear and thick as jelly.

This formula makes a good soap

Useful as an ingredient of fat-liquors. For three gallons of soap use two gallons of tallow, and one-half gallon cotton-seed oil. Mix together while both are lukewarm. To this mixture add one quart of caustic soda that has been slowly dissolved in two quarts of water in an earthen vessel. As a fat-liquor for seventy skins take ten pounds of soap to five gallons of water, boil thoroughly then add one gallon of degreas. Emulsify thoroughly and run in sufficient water to mill the skins in.

For some purposes concentrated aqueous solutions of soaps

Are required, in which instances potash soaps are preferred. A potash soap extremely soluble in water is obtained by the saponification of castor oil with caustic potash. Three and one-half parts of mercury albuminate are thoroughly mixed with thirty parts of caustic potash, and the mixture is then poured into one hundred and fifty parts of castor oil. In place of castor oil cotton-seed oil may be used. The mixture is boiled and constantly stirred, and then allowed to evaporate to about two hundred and fifty parts and is then permitted to cool.

Another soap is prepared as follows: One hundred parts of cocoanut oil, or cotton seed or other oil, are saponified with fifty parts of caustic soda, to which two parts of mercury albuminate have been added. For this purpose two parts of mercury albuminate are well mixed with ten parts of caustic soda until a perfectly uniform paste is obtained, when forty parts of caustic soda are added and the mixture is then poured into one hundred parts of cocoanut oil. The mass is constantly stirred until the saponification is complete and a uniform soapy mass is obtained, when the vessel is well covered and allowed to stand for some time. After two days standing the soap is ready for use.

BLACKING AND SOFTENING COMPOSITIONS.

A useful composition of matter to be used in the cleaning, blacking and oiling of leather may be made of the following ingredients, in the proportions named: Ten quarts of water, two ounces of bichromate of potash, two ounces of prussiate of potash, one pint of neatsfoot oil, one-half pound best lampblack, seventeen bars of Acme soap, one pound of castile soap—the two kinds of soap to be finely shaven and boiled in water until no lumps are seen. Then the other ingredients are added, and all thoroughly stirred together. Then the mixture is poured into pans for cooling. The

bichromate and prussiate of potash serve to harden the soap and to fix the color. The Acme soap is well known, and is considered more perfectly adapted to the purpose for which it is here employed than any other ingredient. The bars in which it is sold weigh one pound each. German-town lampblack is preferred because it is the purest lampblack in the market. In using this composition, the leather should first be freed of all impurities by washing in clean water. Leather, no matter how hard and dry it may be, is given a new lustre and made soft and pliable. This composition has been patented by Henry Parker, Wilmington, Del.

Another composition of matter useful in softening

And adding to the durability of tanned leather, is made of the following ingredients: Eight and one-half gallons of water, two pounds of gambier, one-half pound of beeswax, five pounds of glauber salt and one and one-half pounds of lampblack, all boiled together in a kettle until entirely dissolved. Five pounds of beef suet are melted and strained through a fine sieve, and three quarts of water and twelve ounces of concentrated lye are added, and boiled until well mixed. Then the two solutions are combined and boiled slowly. Then after boiling, two gallons of crude coal-oil are added and the mixture stirred until it is cool. A few drops of cassia and alcohol may be added. This composition is applied to the grain or the flesh side of the leather with a sponge or rag. No previous preparation of the leather is required. In finishing the flesh side, the lampblack is omitted. It is useful in softening hard and dry leather, and restores old, brittle leather to a condition of softness and pliability. Belting, boots or shoes and harness may be improved by its use. Leather may also be finished with it. Boots or shoes may be polished with the use of shoe blacking after an application of the composition, receiving a bright polish. Patented by E. Z. Coffee, Philadelphia, Pa.

A leather dressing possessing waterproof qualities

Is sometimes very useful for the purpose of preserving, blacking and polishing leather. Such a compound may be made of beeswax, neatsfoot oil, drop-black, heel-ball and molasses. Of these articles, two ounces of beeswax, four ounces of neatsfoot oil, one and one-half ounces of drop-black, two ounces of heel-ball and one ounce of molasses are used. These ingredients are mixed and thoroughly amalgamated in the following manner: The neatsfoot oil and drop-black are mixed by trituration and ground in any suitable vessel, until they are thoroughly mixed together. Then the molasses is stirred in. In the meantime the heel-ball and beeswax are to be heated together in any suitable vessel until they reach the boiling point. Then the neatsfoot oil, drop-black and molasses are stirred into the heel-ball and beeswax, and the whole compound thoroughly mixed and boiled so as to still further amalgamate them, and to bring them into complete affinity with each other. Then the mixture is allowed to cool and again mixed by trituration, so as to overcome the tendency of the heavier ingredients to gravitate while the compound has been in a melted condition. This compound may be applied to harness or other kinds of leather by means of a brush or cloth, or by any other suitable thing. As no expensive elements enter into the composition, it is very economic in its production. It produces a surface highly impervious to water, while of itself it is very penetrating and diffusive and renders the leather very soft and pliable. A sufficient quantity of its waxy ingredients remains upon the surface of the leather to constitute a smooth, hard and glossy finish, which does not transfer the coloring ingredients to objects that come in contact with it, and which being elastic and pliable, does not crack under the influences of frost and heat. Patented by J. J. Baulch and others, St. Louis, Mo.

TO PUT WEIGHT INTO SOLE LEATHER.

Make a strong liquor, say 40 degrees barkometer test, or over. This can be made of liquor from the leaches strengthened up by the addition of bark extract or quebracho extract. After withdrawing the leather, wash it clean, partially sammy and then give the grain a coat of oil and the flesh a coat of sugar and Epsom salts. If the leather is hard give it 70 per cent. sugar and 30 per cent. Epsom salts. If it is soft give it 50 per cent. sugar, and 50 per cent. of 42 degree glucose. You can use from one-half pound to three pounds per side or about ten per cent. of the weight of the leather. Epsom salts have a softening tendency, and glauber salts may be used instead. Both materials produce good results.

LACTIC ACID IN PLUMPING AND TANNING LEATHER.

The following interesting process is patented by Sigmond Saxe, of New York City: There are several steps in the ordinary tanning process. A number of vats are usually provided and are filled with tanning liquor of different degrees of strength, the hides being placed in the vat containing the weakest liquor, and thence removed to the next vat in which the liquor is stronger. Some tanners prefer to let the hides remain in a single vat and to change the liquor around them. When this is done, the liquor first brought into contact with the hides is comparatively weak, and stronger liquors are used as the tanning progresses. In the ordinary processes of tanning the natural tan bark for instance, the bark of the chestnut-oak (or the extract of quebracho wood) is leached or steeped in water for the purpose of making the tanning solution. At other times the tanning liquor is made of a solution of some one of the other commercial tanning extracts, dissolved in water. Sometimes, too, the tanning liquor consists of a double solution containing both the leached extract of natural bark and a commercial tanning extract prepared artificially.

This invention relates more particularly to tanning processes in which either a commercial tanning extract is used exclusively, or in which an extract is used with extract obtained by leaching bark. A twenty-five per cent. solution of ordinary commercial lactic acid is taken and apportioned to the quantity of hides to be tanned at the ratio of one-half to three-quarters of a pound of this acid for every one hundred pounds of hides. This fixed proportion is preserved no matter what may be the purpose for which the hides are tanned, or what may be the stage of the tanning process. Putting this commercial lactic acid into the solution, the tanning process goes on as stated with this difference,—to wit, the lactic acid plumps the hides—that is causes them to distend and swell, and thereby tan more quickly. As the commercial tanning extracts are of vegetable origin, and as the natural tanning extract obtained from the natural bark produces a tanning solution also of vegetable origin, this process is peculiarly applicable to so-called “vegetable” tanning.

The addition of lactic acid to the tanning liquor causes the hides to retain their substance and to combine with a larger proportion of the tannin, thereby making a superior quality of leather, having a proportionately heavy weight. By this process a greater amount of tannin is made to combine with the albumen of the hide, than when other methods of tanning are used.

In place of sour liquors used to plump the hides a liquor made of commercial tanning extracts to which some lactic acid has been added, is preferred. When a combination tanning liquor is used, made of the extract of the natural bark and tanning extract, the addition of lactic acid is an advantage as well as in a process employing a commercial tanning extract alone. Lactic acid may also be used in any process of retanning. For the retanning it is customary to use a mixture of the extract of natural bark and commercial tanning extract.

LOGWOOD LIQUOR.

Into eighty gallons of water put seventy-five pounds of logwood chips, and a few ounces of sal-soda. Boil for two hours. Before using add a small quantity of either ammonia or sal-soda to each pailful of logwood liquor. Use the liquor warm, at a temperature of 110 degrees. The grain of leather should always be well filled with the logwood liquor before a striker is applied. When a "sig" is required a solution of caustic soda and salts of tartar may be used—three pounds of the soda and three pounds of the salts boiled in fifty gallons of water.

CLEARING LEATHER WITH ALUM AND SALT.

Leather that is to be colored fancy shades is greatly benefitted by being cleared in a drum with a solution of alum and salt. This process is especially good for gambier and combination tanned Russia leather. The leather is taken in dry condition and uniformly moistened with warm water in a tub. It is then transferred to a drum and run for twenty minutes in the alum and salt—three quarts of alum and five quarts of salt being used for each one hundred and fifty pounds of dry leather. At the end of the twenty minutes the leather is washed off and given the first fat-liquor, dried out, colored and finished. Upon Russia leather, both black and colored, sulphated oil makes a very good fat-liquor.

Borax and lactic acid

Are also used upon this class of leather for the purpose of bleaching it and clearing the grain of grease and spots. This is a safe and efficient process, as it leaves no undesirable effects upon the leather. The leather, taken from the tanning liquor is pressed and shaved and given the first fat-liquor and dried out. It is then moistened in a drum or tub with warm water and then given the borax, in quantity about five pounds for each one hundred and fifty

pounds of dry leather, dissolved in twenty gallons of warm water. The borax solution at the end of fifteen minutes is drained off and a lactic acid liquor given to the leather, made up of two gallons of acid in fifty gallons of warm water. The leather is run in this liquor for fifteen minutes, then washed thoroughly and is ready for the coloring process. The borax thoroughly cleanses the leather, and saponifies whatever fat or grease there may be in the grain, and the lactic acid clears the grain and opens it so that the coloring material can readily penetrate and produce deep and uniform colors.

BLEACHING LEATHER WITH SULPHURIC ACID AND SUMAC.

This process is useful in bleaching russet, skirting, Russia leathers, and in fact any class of leather that requires bleaching. Taken from the tanning liquors, pressed and shaved, the leather is first treated with sumac. Three pails of dry sumac in twenty-five gallons of hot water are required for fifty medium-sized sides or the equal or proportionate number of calf skins. Run the leather in the sumac liquor for twenty minutes, then allow it to press and drain. The first part of the bleaching process consists of the use of sumac and muriate of tin. Fifty gallons of water, eight pails of dry sumac and four pounds of muriate of tin are used, the whole being boiled and used at a temperature of 125 degrees. Drum the leather in enough of this liquor to cover it, for one hour, then drain the liquor off and add sulphuric acid, about twenty ounces of the same being used for the quantity of leather mentioned above. Wash the leather for five minutes in this acid liquor, then wash it off in cold water and then dry it, after which it is ready for fat-liquoring, or coloring as it may require.

For Russia leather, and other similar stock, another formula may be used, namely: two pails of dry sumac, sixteen ounces of sulphuric acid and four quarts of salt for each one hundred and fifty pounds of leather weighed in the dry state,

after being fat-liquored and dried out. The leather is softened with warm water in a drum, then the sumac is put in, next the salt and finally the acid. In this liquor the leather is run for thirty minutes, then it is washed thoroughly for fifteen minutes in clear water and is ready for the coloring process. For colored leathers, fat-liquors made of oil, soap and degreas produce the best results. The best oils for the purpose are neatsfoot, cod and sod oils.

Oxalic acid is also used as a bleaching agent upon leather. Sometimes it is used alone and again it is combined with tin crystals. Sixteen ounces of oxalic acid and eight ounces of tin crystals are used for each one hundred and fifty pounds of dry leather. Run the leather in the liquor for twenty minutes, wash it thoroughly and give it color. The leather is usually fat-liquored and dried out before it is bleached.

APPENDIX.

BEAMIT.

ONE-BATH BEAM-HOUSE PROCESS.

Beamit, which is manufactured by the American Hide Process Co., Chicago, Ills., is claimed to be a compound resulting from many years work on the part of a chemist associated with that of a practical tanner, and is said to offer the following advantages:

It takes the place of liming, arsenic, sodium, etc., for unhairing hides, horse hides, calf, kip, sides and wool pelts. It does not hurt or injure the hands of the workers in any manner, is simple to use and certain in its action.

After the hides or skins have been thoroughly soaked and fleshed they are immersed for twenty-four hours in a solution of Beamit. Heavy stock may perhaps require one handling during the 24 hours. Stock soaked in the solution is passed directly to the beamsters for unhairing.

Beamit-soaked hides unhair very readily, the fine hair and the scurf go with the hair. After unhairing, the stock should be washed in a bridged wheel, with luke-warm water. It is then in condition to receive tannin of any kind. That is to say, stock after being soaked and fleshed can in twenty-four hours' time be ready for the liquor, thereby making a great saving in time and labor as compared with the present process of tanning.

Beamit leaves the skin in a clean and pure condition, so that it will rapidly absorb anything given to it. Care therefore must be taken not to use bate, pickle or tan liquor too strong.

Bate and Pickle.—The use of one or both of these can as a rule, be dispensed with, but for soft velvety grain, certain leathers and some natural skins it may be found advantageous to use an extremely light bate or pickle or perhaps both. If the

tanner decides to bate he will find two hours' time in an exhausted bate sufficient, and the same holds good in regard to pickle.

Tan Liquors.—For chrome tan the liquors should be reduced in strength at least 50 to 75 per cent. on the first bath, and strengthened from time to time as the tanner sees fit. In the chrome liquor a skin in a paddle wheel should require from 3 to 4 days to tan ready for the shaving room. In vegetable tan the treatment should be precisely the same as for limed skins, but the liquor must be greatly reduced in strength to prevent the skins being over-tanned.

Beamit does not remove the gelatine (gluten) from the skin, therefore it makes plumper leather, and will make foot for pound in chrome leather, as no shrinkage of the skin occurs. In vegetable tan the skin makes plumper leather and yet makes as large a percentage of measure as limed skins. Beamit treated skins absorb dye and fat liquor much more quickly than limed skins. They dry rapidly on the tacking frame, stake, board and glaze easily, taking all finishes rapidly. Leather from skins treated with Beamit and properly tanned will not crack on the grain. The grain is flexible and cannot be "pipey" on a fair skin. On a murrain skin where there is a good hide there is good leather, and where there is flanky leather it is better than that on limed skins.

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